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The Progress of Discovery and Exploration Within the Arctic Region*

WILLIAM HERBERT HOBBS

The civilization of the ancient world developed about the Mediterranean and expansion proceeded westward to the Atlantic and later southward and eastward to the Indian and Pacific Oceans.

PYTHEAS THE PIONEER IN ARCTIC EXPLORATION

During the conquests toward the East of Alexander the Great there started the first Arctic exploring expedition, though this was in the 4th century before the Christian era. The Greeks had established a colony at Massilia in the western Mediterranean, the modern Marseilles, which produced a remarkable astronomer-mathematician, Pytheas. The latitude of his home city Pytheas determined from the shadow of a gnomon or tall pole measured at noon of the solstice, a value which checks closely with values obtained today. He then as a guide in navigating fixed upon the nearest stars to the pole. To determine his latitudes during his journeys he used the method of the gnomon and thus was sometimes forced to wait for months for the solstice. From the latitudes which he determined, he must have been absent from his home at least six years.

Without any means of fixing position at sea, ships of his day, and until many centuries had elapsed, groped along shore from headland to headland, seldom going out of sight of land. Pytheas's accounts of his own voyages

* Presidential address delivered before the Association of American Geographers at Syracuse, New York, on January 1, 1937.

have not survived, and we know of them only through the writings of Strabo and Pliny quoting hostile critics, for Pytheas's true accounts of Arctic conditions aroused only ridicule at the time.

In a ship provided with both sails and oars Pytheas passed between the Pillars of Hercules (Gibraltar) and the Sacred Promontory, the western limit of the known world, Cape St. Vincent. He then pushed northward up the coast and across the channel to Cornwall, where he found the source of the tin that had been reaching Massilia from the North. At the modern Ushant he fixed the latitude on the summer solstice. Proceeding now up the coast northward he took latitudes near Flamborough Head and Tarbat Ness in Ross-shire, Scotland. As he advanced northward he found the cultivated grains and fruits and nearly all the domesticated animals had gradually become scarce and all but disappeared, the people living on herbs and roots. He pushed still to the northward on the northern coast of Scotland to the Orkneys, which he named Orcas, and probably to the northernmost of the Shetland Isles near latitude 61° N.

At the Orkneys he learned of an Arctic land called Thule which was six days' sail farther near the frozen ocean, probably Northern Scandinavia, where at the summer solstice there was no night and where in another season there was no day. Is it any wonder that he was dicredited when he reported such extraordinary conditions?

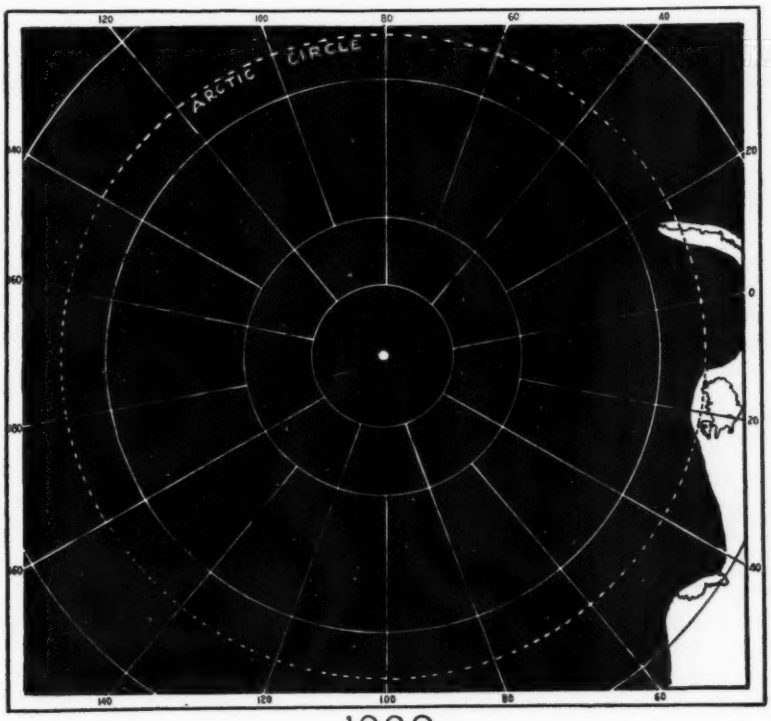
Pytheas sailed also along the northern coast of Europe to the Baltic where he located the source of the amber that had been reaching Massilia. From the accounts Rasmussen thinks he proceeded up the Scandinavian coast as far as Bodö, just beyond the Arctic Circle. Although with little doubt the desire to tap the sources of tin and amber influenced those who may have helped to fit out the expedition of Pytheas, with him at least the urge was largely scientific, the desire for scientific geographic exploration. It is sad to reflect that it was the very accuracy with which he described his discoveries which brought him at the time into discredit and even ridicule.

THE VIKING AGE OF EXPLORATION

It was only after a lapse of twelve centuries that exploration toward the Arctic was again started with the raiding expeditions of those bold seamen, the northern vikings. They roamed the waters of the North Sea and plundered the coasts of France, England, Scotland and Ireland, after which they pushed out westward and northward as well as eastward. Though the compass had not been invented, courses on the open sea were then crudely kept by the general direction of the sun or a star or of prevailing winds; and with broad coasts both to the east and west of the North Sea, the error of five or even ten degrees was not a serious one.

Ireland seems to have been one of the earliest lands of Britain to be raided, for Irish monks seeking a refuge from the vikings reached, no doubt accidentally, both the Faroe Islands in latitude 62°–63° and also Iceland just south of the Arctic Circle, whither the vikings followed them in 870–890 A. D.

In 870 the viking Othere, or Ottar, sailed to the eastward, rounded North Cape in latitude 71° N. and then still further and perhaps to the White Sea. At the end of the 9th century southern Greenland was discovered by accident when Gunbjörn, sailing from Iceland, was driven in a storm onto the east coast. A century later an Icelandic peasant named Erik the Red, who had been banned from the country for a murder he had committed, set out to follow the course of Gunbjörn, and in 983 reached the extreme south coast of Greenland. Returning and describing the land in pleasant terms as Greenland, he was able to assemble colonists who in 986 set sail for Green-



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MAP 1.—Northern Exploration up to 1000 A. D.

land in a fleet of no less than 35 ships, 14 of which reached their destination. The others either sank, were lost, or turned back. Leif Ericsson, the son of Erik, in 1002, sailing westward, reached the mainland of America in Labrador and probably also Nova Scotia and Cape Cod, though Bjarni had probably reached Labrador in 986. (Map 1.)

THE AGE OF DISCOVERY

After the discoveries of the vikings, expeditions to the North largely ceased until the great age of adventure and discovery which opened in the fifteenth century, and which was due to several causes. In the main, however, the products of the Far East, the wealth of jewels, silks and spices, had long been coming overland to Europe by caravan, and the luxury of the East had been made known by Marco Polo and others. The crumbling of the Mongol Empire and the extension of the power of the Ottoman rulers had shut off this direct land trade with the East, which held also the lure of the mythical Prester John, a powerful oriental potentate friendly to the Christian nations. Driven to the sea, if the East was to be reached, there were two new inventions which made possible a groping navigation upon the open sea. The compass had come into use in the 14th century and in the 15th the cross-staff and its modified form, the astrolabe, had been devised to determine latitude from altitude of the sun or a star above the horizon. Under the strong influence of Prince Henry the Navigator, the Portuguese and later the Spaniards, had found a southern route by sea to the Orient and by Papal decision had divided the seas between them.

THE SEARCH FOR THE NORTHEAST PASSAGE TO THE FAR EAST

The maritime nations of northern Europe now set out to discover a northern route, either a northeastern passage or a northwestern one, to the trade centers of the East. Under this impulse directly and indirectly it has been estimated that in all no less than 186 Arctic expeditions were sent out. Both routes of a sort were eventually to be discovered when any practical use for them had long since passed.

In the middle of the 16th century King Edward VI of England and the King's friend and companion, Sir Henry Sidney, took a warm personal interest in the maritime prosperity of the country. With their support and encouragement the first real Arctic expedition was organized and sent out by the Company of Merchant Adventurers, the Muscovy Company, to undertake a voyage to Cathay, or China, by a northeastern route. This alliance of merchants organized to promote trade was destined to play a great part in the Arctic exploration of the years to come. Under command of Sir Hugh Willoughby with Richard Chancellor next in command three ships left England in 1553, crossed the Arctic Circle, rounded North Cape, and dis-

covered southern Novaya Zemlya and Lapland. Chancellor, whose ship had become separated, reached the White Sea.

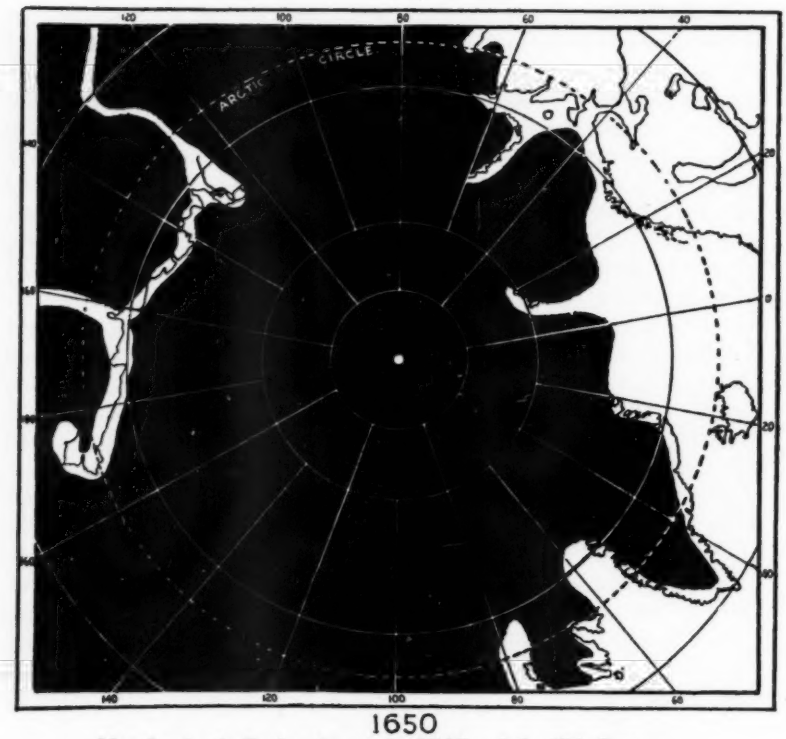
The Dutch were now to play an important rôle in Arctic exploration and contribute a great explorer in Barentsz who, though always in a subordinate position, became recognized as the real explorer of the expeditions. In 1578 a Dutch ship had already reached the mouth of the Dwina River on the White Sea, and in 1594 a small Dutch fleet with Barentsz in command of the *Mercury* skirted the west coast of Novaya Zemlya to the Orange Islands in the extreme north, latitude 76° 20′, and rounding Cape Nassau was stopped by ice floes. In 1596 Barentsz sailed again and reached Bear Island south of Spitzbergen in about latiture 74°, and still pushing north reached the northwest point of Spitzbergen (now Svalbard) in latitude 79° 49′. The fleet returned to Bear Island and one vessel, under the guidance of Barentsz, then sailed eastward, and rounded the north point of Novaya Zemlya, which Barentsz had approached two years before. The ship was beset, the party wintered on the northeast coast, and rescued itself without the ship a year later. Of Barentsz, Markham says, "his deeds exceeded all those of the 16th century."

RUSSIAN EXPLORATION OF THE SIBERIAN NORTH COAST

Explorers from Western Europe did not, until late in the 19th century, again go to the eastward of Novaya Zemlya, the scene of interest having having shifted to the northwest; but during the early period of occupation of Siberia by the Russians, portions of its Arctic coast were reached by the Cossack leaders who were engaged in reducing the native tribes. Thus the mouth of the Yenesei was reached in 1610, and those of the Lena and Yana (ten degrees east of the Lena) in 1636. In 1648 from the mouth of the Kolyma Deshneff sailed eastward along the icy coast, passed through Bering Strait and reached the Gulf of Anadyr. The cape west of Bering Strait has received his name. (Map 2.)

The Russian explorers did not take up discovery of the North Siberian coast until almost a century later. In 1734 Russian officers starting in ships from Archangel in European Russia reached the river Obi and, building vessels at Tobolsk on that river, Owzin was able to reach the mouth of the Yenesei, and Sterlegoff set out northward from its mouth and attained a latitude of 75° 26′ N. before turning back.

Attempts to round the northernmost point of Siberia from the east were started in 1735. In 1736 Prontchischeff was able to force his way almost to the northern point. In 1739 a new attempt was made by Laptef from Yakutsk on the Lena with Chelyuskin as mate. They were stopped by ice at Cape St. Thaddei in latitude 76° 47′ N. and wintered there but, despair-



MAP 2.—Arctic Exploration at the Middle of the 17th Century.

ing of reaching the objective, Laptef next season turned back, was wrecked and had to winter again. In 1741 Chelkuskin with sledges traced the coast line and reached the northern point in latitude 77° 30′ N., which now bears his name. Laptef explored the Taimyr peninsula.

While these explorations of the north Siberian coast were going on, one of the greatest explorers was putting through an expedition destined to make his name immortal. Vitus Bering was a Dane who had taken service in the new Russian fleet formed under Peter the Great. Just before his death in 1725, Peter commissioned Bering to cross Siberia, much of it then quite unknown, to the Pacific, there build ships and explore the confines of his Empire. In this vast enterprise he succeeded, built two ships with the aid of shipwrights and carpenters as well as much material carried with him. In 1728 he rediscovered Bering Strait and Sea, and in 1741 discovered Alaska and Mount St. Elias, and he explored the Aleutian Islands. His

ship, *St. Peter,* was wrecked on the island in the Commander group east of Kamschatka which now bears his name, where he died in 1741.

THE SEARCH FOR A NORTHWEST PASSAGE TO THE EAST

The attempts to find a northwest passage to the Orient were undertaken largely by England under the powerful sponsorship of the Company of Merchant Adventurers, solid shipowners whose names are now found attached to major features of the Arctic given by their explorer shipmasters. The first of these expeditions, made in 1576, was sent out under Martin Frobisher, one of the greatest of the Elizabethan seamen, about a score of years after Willoughby had begun the search for the northeast passage. Frobisher discovered the bay just north of Hudson Strait which now bears his name, and from the northern shore he brought back a dark rock specimen with glittering particles now well known as "fool's gold," or iron pyrites. As a consequence of this a gold mining company was formed in England under great excitement, and when Frobisher again sailed in 1577, it was in three vessels and was not for the purpose of exploring at all, but to bring back gold ore. The ships came back loaded with the black rock, the worthless nature of which had not yet been exposed, and in 1578 Frobisher sailed yet again, this time with a fleet of fifteen vessels, and arrived at the entrance of what is now Hudson Strait. On these voyages Frobisher used for fixing the latitude a modified cross-staff called a "ballestilla" and with it he found he was sixty miles south of Frobisher Bay. Frobisher's instructions permitted exploration and, after an angry discussion with other officers who would go at once to the mine and left him, he sailed into the Strait accompanied by the vessels of several loyal captains, and kept on westward for six to seven days. Frobisher was one of the great Arctic heroes.

Another of the great British explorers of the Elizabethan period was John Davis, who in 1585 set out in two vessels of 50 and 35 tons only. Like Frobisher he rediscovered Southern Greenland, but rounding Cape Farewell he skirted the coast in a northerly direction and sailed into the harbor of Godthaab, which he named Gilbert Sound. He then sailed west northwest across the strait which separates Greenland from Baffin Land, and now bears his name. Returning down the west coast he skirted the coast of Labrador and the north coast of Newfoundland before returning to England.

In 1587 Davis sailed to the North again and this time was stopped by the ice just south of Upernivik in Northwest Greenland in latitude 72° 12′ N. Crossing the bay he entered Cumberland Gulf in Baffin Land, which at first seemed to offer the much desired "northwest passage."

England was now threatened by the Spanish Armada, and as all ships were needed for defense, it was a score of years before Arctic exploration was renewed. Then with Britain's power upon the sea reestablished during the late Elizabethan era, this dominance is reflected in her hardy Arctic explorers, with Henry Hudson and William Baffin worthy successors to Frobisher and Davis.

HUDSON AND BAFFIN

Hudson's voyages of exploration were made in the last four years of his life between 1607 and 1611. On his first voyage of discovery he reached the east coast of Greenland, up which he coasted as far as latitude 73° N., then skirting the pack ice he reached Spitzbergen near where it was seen by Barentsz. He later explored the entire west Spitzbergen coast and reached 80° N. There he encountered great numbers of seals, walrus and especially whales, and this voyage was the starting point of the great whaling industry which for more than two centuries was to be centered there with strong rivalry between the British and the Dutch, with frequent clashes and with men of war brought in to protect the whaling fleets.

On the return to England Hudson discovered in latitude 71° the volcanic island of Jan Mayan about halfway between Spitzbergen and Scotland. On his second voyage Hudson rediscovered Novaya Zemlya but, finding no passage through, turned back. His third voyage, in the service of the Dutch, resulted in the discovery of the Hudson river and the site of New York City; and on his last voyage, made in British service, he passed through Hudson strait and must have explored most of the east coast of Hudson Bay before he was abandoned in an open boat by a mutinous crew and never again heard from.

William Baffin made five voyages to the polar regions. In 1616 he explored the north coast of Hudson Strait, and the following year sailed up the bay which now bears his name and pushed as far as latitude 78° N. into the sound which he named after Sir Thomas Smith, and has ever since been Smith Sound. Turning southward and skirting the west coast of Baffin Bay he discovered Lancaster and Jones Sounds, both destined later to lead to a northwest passage. Baffin was an accomplished astronomer and took lunar observations for longitude, determined the variation of the compass and made a study of the tides. Because of these studies and the features of his voyage which he correctly described, he was, like Pytheas twenty centuries earlier, rather widely discredited in Europe until splendidly vindicated by Ross, who explored in the same region two full centuries later. In the same period as Hudson and Baffin Southampton Island and the west shore of Hudson Bay were explored by Button in 1612, and the Fox Channel to the North was discovered by Foxe in 1631.

THE EXPLORERS OF THE FUR COMPANIES

As Hudson's discoveries in northwest Spitzbergen had led to a great whaling industry there, so the discoveries on the west coast of Hudson's Bay brought into being a great industry in the procuring of valuable pelts from the wild animals of the hinterland, and this was to lead to great geographic discoveries.

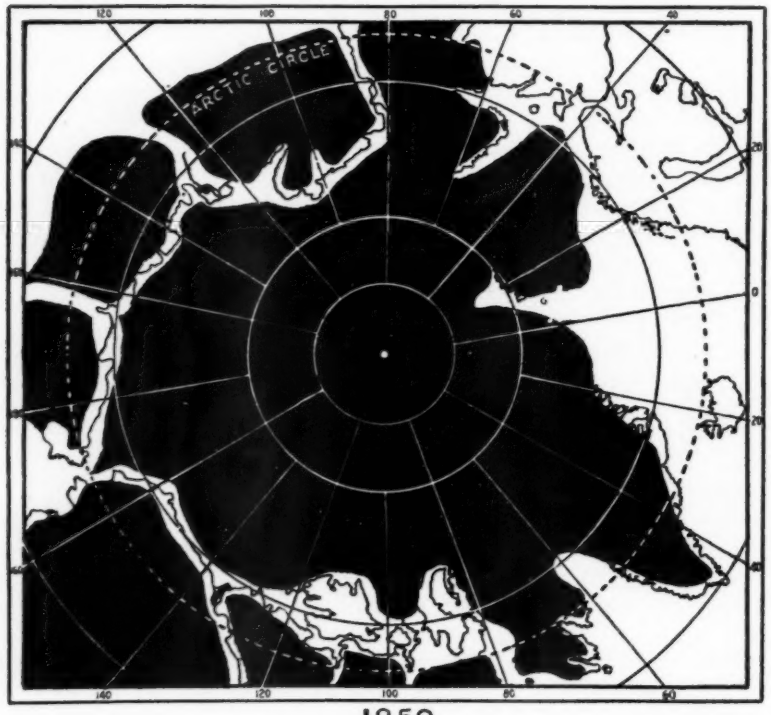
In 1670 "The Governor and Company of Adventurers of England Trading into Hudson's Bay," the Hudson's Bay Company, was founded. There followed in 1723 a Paris organization, the firm of Revillon Frères, and in 1743 the "North-West Company," a rival to the Hudson Bay Company, with which it was united in 1821. The English companies were interested to discover the Northwest Passage, and their explorers starting out from the trading posts on the west shore of Hudson's Bay, travelled by canoe northward down the great rivers which were found to debouch into the Arctic Ocean. In 1771 Samuel Hearne of the Hudson's Bay Company descended the Coppermine River to its mouth.

In 1789 Alexander Mackenzie for the Northwest Company descended the great river which now bears his name to the delta near its mouth. A decade earlier the great navigator, Captain James Cook on his third voyage had already passed through Bering Strait, crossed the Arctic Circle and reached Icy Cape in latitude 70° 6′ N., less than a degree south of the northern point of Alaska.

In 1819 John Franklin set out from York Factory, descended in a canoe the Coppermine River to its mouth and proceeded eastward along the Arctic coast for six and a half degrees of longitude. Where he turned back he named the point Cape Turnagain. With his subordinates, some of them later to become famous as explorers, he had terrible starving conditions but finally reached his base. Between 1825 and 1827 with Back, Franklin canoed down the Mackenzie River to its mouth and paddling westward he discovered 374 miles of new coastline until he reached Cook's farthest east at Icy Cape. Richardson and Kendall at about the same time were exploring the coast between the mouths of the Coppermine and Mackenzie Rivers.

In 1833 Back reached Great Slave Lake and descended the Great Fish River to its mouth in longitude 93° W., and turning west travelled toward Franklin's Cape Turnagain, a distance of 18 miles. Simpson explored the coast westward from the mouth of the Mackenzie to Colville River and thence overland to Cape Barrow, and in 1839 he explored the coast between Franklin's farthest east at Cape Turnagain and the mouth of the Great Fish River reached by Back, and then explored the coasts of King William and Victoria Lands, as well as the American coast east of the mouth of the Great Fish River. John Rae in 1845 traced 655 miles of new coast. Start-

ing out from Hudson's Bay he passed Repulse Bay and explored the west side of the Gulf of Boothia to Fury and Hecla Strait. Thus between 1818 and 1846 the complete northwest coast of America had been traced out by these hardy British explorers. (Map 3.)



MAP 3.—Exploration up to the Middle of the 19th Century.

ROSS AND PARRY

Near the beginning of the 19th century in seeking the passage to the Orient, more attention was directed toward a course by way of the North Pole. William Scoresby, distinguished son of another William Scoresby, and both whaling captains, had twice found the seas north of Spitzbergen unusually clear of ice, so that he was able to get as far as 82° N. He recommended to the British Admiralty this route across the Pole. The result was two expeditions both sent out in 1818, one of them by this route under Buchan, and the other under John Ross by way of Smith Sound. Ross was

to check the then much discredited reports of William Baffin. About the only tangible result of Buchan's expedition was to show pretty conclusively that the route past Spitzbergen was an impracticable one.

Ross had with him two men later to attain fame as polar explorers, Edward Parry, second in command, and James Ross, his nephew. Proceeding in two ships up to Smith Sound, Ross gave the names to Melville Bay and Cape York, features to become familiar to all later explorers by this route. Ross met the Cape York Eskimos, but did not push through into Smith Sound and discover that it was a channel. He tried to pass into Lancaster Sound, but was turned back by the barrier of the "Croker Mountains," which he believed to close these waters. He therefore, against the advice of Parry, turned back, and as a result was very sharply criticized. His expedition was useful in reestablishing Baffin's good name, as it was in training Parry and James Ross.

Dissatisfaction with Ross over his failure to explore properly Smith and Lancaster Sounds so as to discover whether they were channels, resulted in sending out Parry in 1819 in the ships *Hecla* and *Griper*. Parry found the "Croker Mountains" to have no existence, and sailing through the Sound, which proved to be a channel, he pushed southward for 150 miles through another passage which he named Prince Regent Inlet, with Somerset Island in the west. Returning to the west end of Lancaster Sound, he discovered Wellington Channel directly northward, but turned westward through Barrow Strait to Viscount Melville Sound, and, skirting the south coast of Melville Island, he crossed the 110th meridian and so gained a bounty of 5000 pounds. He wintered and in the following summer explored Melville Island and discovered other large northern islands of a group now known as the Parry Islands. He then freed his ships from the ice and reached England in October, 1820, after one of the most fruitful polar expeditions of all time.

In a second expedition going out from the north shore of Hudson Bay in 1821, Parry explored Frozen Strait and Melville Peninsula and discovered Fury and Hecla Strait, which connects the Gulf of Boothia to the Fox Basin. On his third voyage Parry again passed through Lancaster Sound and Prince Regent Inlet and wintered. In the succeeding summer before getting clear, one of his ships was wrecked, but he was able to get the expedition home in the other. In 1827 he set out on his fourth expedition, this time to the north coast of Spitzbergen where he brought his ship, the *Hecla,* to anchor. From the ship Parry set out with two heavy flat-bottomed boats to reach a high northing through and over the pack ice. He was able to attain a latitude of 82° 45′, which was to stand as a record for half a century.

John Ross had been so discredited after Parry had shown his "Croker Mountains" to have been only a mirage, that all his efforts to obtain government support for another expedition were futile. At last his wealthy friend, Felix Booth, gave him $90,000 for a new expedition and in 1829 he sailed in the ship *Victory* over his own "Croker Mountains" in Lancaster Sound and, proceeding down Prince Regent Inlet, he discovered 276 miles of previously unknown shoreline and the great Boothia Peninsula. In this expedition was his nephew, James Ross, later to become famous on a sledge journey which took him 200 miles from the ship, and who explored the Boothia peninsula and discovered the North Magnetic Pole of the earth, then in latitude 70° 5′ 17″ N. and longitude 96° 16′ 4″ W. After four successive winters spent in the Arctic, with the ship still beset, the party set out in boats for Lancaster Sound, where unexpectedly they encountered Ross's old ship the *Isabella* on a whaling cruise, and so were able to return to England. Over 260 miles of new coast land had been discovered by Captain John Ross himself, and another 500 on the sledge journeys of his nephew, James Ross. After this remarkable voyage John Ross was knighted and acclaimed.

THE SEARCH FOR FRANKLIN

In 1845 a new expedition to discover, if possible, a northwest passage set out from England in the ships *Erebus* and *Terror* under the command of the veteran British explorer, Sir John Franklin, who had with him supplies sufficient for five years for his large complement of no less than 129 men.

Making his way up Melville Bay Franklin in August fell in with two whaling vessels, by which letters were sent back to England, and thereafter he disappeared into the unknown, and before the mystery of his expedition had been cleared up thirteen years had elapsed.

When in 1848, after three years, no word had been received from the Franklin Expedition, Richardson and Rae were sent out to search the north coast of British America between the mouths of the Mackenzie and Coppermine rivers. Two ships of a search expedition were also despatched under Sir James Clark Ross, and though nothing was accomplished in the way of tracing the Franklin expedition, yet this expedition was notable for bringing into the Arctic a group of young men, all later to become famous as explorers. These were McClure, M'Clintock, Ommanney, Vesey, Hamilton, Sherard Osborn, and Mecham. This expedition also marks the beginning of a prolonged search in which forty separate expeditions participated before the mystery was laid bare. The search was fruitful in supplying great geographic knowledge of the Arctic region. In 1850 alone sixteen expeditions went out, one of them an American one in the ships *Advance* and *Rescue* under the command of Lieutenant De Haven. This expedition

under De Haven was known as the First Grinnell Expedition. De Haven pushed his way through Lancaster Sound to Wellington Channel, where the ships were beset, to drift northward into Wellington Channel and discover Grinnell Peninsula, then throughout the winter and spring to drift eastward into Baffin Bay and be set free only in the following July.

In the same year Collinson and McClure with two vessels went out by way of the Pacific, but became separated and were not heard from for several years.

Ten of the ships of the search expeditions arrived together at Beechey Island at the entrance of the Wellington Channel, and there they found graves and other remains of Franklin's first winter camp, but no indication as to where the expedition had gone.

In 1852 Sir Edward Belcher set out with five ships to search not only for Franklin, but for Collinson and McClure as well. With McClure connection was established, and when in 1853 the return was made by way of the Atlantic, the first northwest passage had been effected by men travelling from West to East, though not by a single vessel, nor in fact throughout in vessels.

In 1852 Captain Inglefield, British Explorer, sailed up Baffin Bay and passed through Smith Sound to reach a latitude of 78° 28′ N. He it was who named the land to the westward Ellesmere Land. In 1854 the Crimean War broke out in Europe and engaged the full attention of Great Britain until its close in 1856. America in nowise concerned, was able before the outbreak of the war to launch a most important Arctic expedition. Dr. Elisha Kent Kane, who had served as surgeon on De Haven's Expedition, started out in command of the Second Grinnell Expedition, in the little schooner *Advance* and with a crew of but seventeen men to explore the passages to the north of Smith Sound. His ship after difficulties with the ice was frozen in in Rensselaer Harbor on the Greenland coast. In a sledging expedition on which he was aided greatly by the Eskimo Hendrick, he was able to map the Greenland Coast in detail and to name its features as far north as Cape Constitution in latitude 81° 20′. His surgeon, Dr. Hayes, sledged even farther to the north on the western side, but his observations appear not to have been accurately made. Kane's expedition, however, was a most important one and it thoroughly explored the great basin which now bears his name, and also the southern part of the Kennedy Channel to the north of it, including Washington Land and the great Humboldt Glacier on the East. Kane gave the name Grinnell Land to the land west of the Kennedy Channel. He became an advocate of the Neumeyer theory of an open polar sea, which, though it was later found to have no existence, yet doubtless greatly promoted exploration through the effort to learn the truth.

By 1855 nineteen arctic expeditions had already gone out in search of Franklin, and within six years $5,000,000 had been spent with nothing learned of his fate. When now the British Admiralty gave up the search, Lady Franklin gave the remains of her entire fortune to outfit an expedition for search under the veteran explorer M'Clintock. M'Clintock set out in July 1857 in the little steam yacht *Fox* and arrived at Melville Bay in the worst ice year then known. The ship became beset and was not set free from the ice until April of 1858 after drifting during the winter 1190 miles over a period of 242 days. Undismayed, M'Clintock, when once more free, again turned north and in a favorable year was able to go through Prince Regent Inlet and pass through Bellot Strait, where he was stopped by ice. Here his sledging expeditions began in the following spring and he scoured the country to the south for traces of Franklin. M'Clintock himself reached Cape Victory on the southwest coast of Boothia Felix, where he at last discovered the remains of the Franklin party and then the whole sad story of the lost expedition. He also sledged entirely around King William Island and discovered 800 miles of new coast line and the only navigable northwest passage.

NEW ASSAULTS ON THE POLE

The idea of an open polar sea which was actively pushed by Kane seemed to offer an easy route to the Pole, and Dr. Hayes was able to secure funds and start north in 1860, but he was not able to make any advance over his predecessor. Eleven years later, however, the American Hall in the ship *Polaris* during what is now clear was an unusually favorable season for ice, sailed in open water up the usually ice-blocked channels to the 82nd parallel—a full degree and a half beyond the farthest then reached by sledges. Here the land seemed to be disappearing and a polar sea beginning. He thus discovered what are now the Hall Basin, Robeson Channel, Newman Bay and Lincoln Sea, as well as Hall Land, a marked advance beyond all earlier work. Cape Joseph Henry in latitude 82° 47′ on the far Grant Land coast, and Cape Stanton on the Greenland coast in latitude 82° 13′ were both seen in the distance.

In 1872 Baron Adolf Erik Nordenskiöld crossed Northeast Land with Palander, and in 1873 the Austrians Payer and Weyprecht discovered Franz Josef Land (now Fridtjof Nansen Land) and reached Cape Fligely, its northernmost point. These explorers considered the new land to be two islands, but it was later shown by Jackson to be an archipelago.

The British in their turn pushed exploration northward by the Smith Sound route and in 1875–76 under Nares they were able to much more than

duplicate Hall's thrust in the *Polaris*. Nares with the *Alert* sailed in open water entirely through the Robeson Channel into the Arctic Ocean and actually wintered in latitude 82° 30′. Thanks to this favorable ice season and also to his good sledging work, Nares established three new records and mapped no less than 300 miles of new coast line, part of which lay east but most of it west of the Robeson Channel. A farthest north in latitude 83° 20′ was made by Lieutenant Markham over the sea ice of the Arctic Ocean.

In 1875 Baron Nordenskiöld essayed the Northeast Passage north of Siberia on an easterly course and reached the mouth of the Yenisei, which he did a second time in 1876. In 1878 in the ship *Vega* with a body of scientists he left Sweden and in the following year was able to accomplish the passage and reach Bering Strait, thus for the first time accomplishing the Northeast Passage.

Before word was received from him of his success, an American expedition in the ship *Jeannette* under Lieutenant G. W. De Long left San Francisco to search for Nordenskiöld. Later learning that he had made the passage successfully, De Long determined to sail for the North Pole, and he passed through Bering Strait and was soon beset. The *Jeannette* drifted throughout two winters, and was then crushed and sunk off the delta of the Lena River.

The party then took to the ice with boats, and one of these, commanded by Chief Engineer Melville, was able to rescue itself in 1881. The other two were lost with twenty men, one of the greater tragedies of Arctic exploration.

As one of the circumpolar stations of the First International Polar Commission an American expedition made up of 24 officers and soldiers under command of Lieutenant Greely, went north in the *Proteus* in 1882 and, proceeding up the Smith Sound route, encountered good ice conditions such as had before been met with by Hall and Nares. Lady Franklin Bay was reached by the ship and a base was there established which was named Fort Conger. Apparently assuming that such ice conditions as had been encountered were usual, no arrangements were made for depots of supplies in case a relief vessel should be less favored. Lieutenant Lockwood of this expedition explored the Greenland Coast to a new Farthest North of 83° 24′, and he discovered also to the west of the base the great Greely Fjord in Central Ellesmere Land. When the relief failed to reach Fort Conger at the time expected, Greely most unwisely abandoned the station with the dogs as well, and without provisions went southward to near open water. Here, at a primitive camp on Cape Sabine, starving conditions prevailed and only six of the original 24 men were alive when they were finally relieved, one of the most tragic outcomes in the history of exploration.

PEARY, NANSEN, SVERDRUP AND AMUNDSEN

The late Eighties of the 19th Century marked the entrance into Arctic work of Peary, Nansen and Amundsen, the three greatest Arctic explorers of all time, and of Otto Sverdrup, second only to them in the importance of his discoveries. Before these men were to finish their work the aspect of the American sector of the Arctic was to be profoundly altered.

Peary, in 1886, with man-hauled sleds made a penetration of the interior of Greenland from the west coast over the inland ice to the then unprecedented distance of 100 miles, in connection with which he prepared a careful profile of the surface along his route. Two years later Nansen by the same sledging method crossed the South Greenland portion of the ice cap from east to west with Sverdrup as one of his companions. Peary in 1892 had learned the value of the Eskimo dogs and with a single companion and with dog-hauled sledges he astonished the world by carrying out a double crossing of far northern Greenland, a journey of no less than 1200 miles without depots. He discovered what is now Peary Land and Independence Fjord in the far northeast, thus making probable, though not at that time proving, the insularity of Greenland. This astonishing feat he repeated in 1895, this time with two companions.

Meanwhile Nansen had designed his polar ship *Fram* and with Sverdrup in command of her he allowed the ship to become beset in the Arctic sea ice northwest of Bering Strait. The *Fram* drifted throughout three years across the Arctic Ocean while soundings and other scientific observations were carried on throughout. Nansen thus found the continental shelf and slope of the Arctic Ocean and added greatly to our knowledge of the meteorology and magnetic properties of that area. When near the 84th parallel of latitude with one companion, he left the *Fram* and in a sledging trip reached a new Farthest North of 86° 13′.

Peary on a four-year expedition (1898–1902) explored and mapped in detail the great fjord area to the west of the Kane Basin, climbed the ice cap of Ellesmere Land, and far to the westward discovered Cannon Bay and Jesup Land, now Axel Heiberg Land since Sverdrup's later explorations. Peary then in 1900 after sledging 350 miles to the northward for a new advance base, explored the entire Greenland north and east coast from Lockwood's Farthest to Wychoff Island 150 statute miles beyond. In 1902 going out from the same advance base of Fort Conger, he pushed out over the sea ice of the Arctic Ocean and reached a latitude of 84° 17′, a new Farthest North for the Western Hemisphere.

Within the same four years, 1898–1902, Sverdrup advanced westward, instead of northward, from the Kane Basin and explored a large and hitherto unknown area which included Axel Heiberg Land, Isachsen Land,

Ellef and Amund Ringnes Land and King Christian Land.

In the Arctic of the Old World area Cagni of the Duke of the Abruzzi's Expedition advanced in 1899 over the sea ice north of Franz Josef Land, and reached a new Farthest North of 86° 34′.

Peary, through building the especially powerful polar ship *Roosevelt* was in 1906 able through heavy ice pack to advance his former base 400 miles farther north to Cape Sheridan on the Arctic Ocean near Nares's base, and starting his sledge journey from there to reach a new northing of 87° 6′.

In great peril he accomplished his retreat to the ship and at once setting out on a new sledging expedition, he closed the gap in the coast line of western Grant Land between Aldrich's farthest west made in 1876 and Sverdrup's Farthest North of 1899.

Stefansson in 1906–07 surveyed areas about Coronation Gulf in Arctic America, and later in a four-year expedition (1908–12) he extended his explorations northward across the Beaufort Sea to Banks Island and discovered and surveyed three large islands within the area west of Axel Heiberg Land and north of Melville Island. Two of these newly discovered islands were Borden and Meighen Islands. He traversed the sea ice on many journeys, made soundings, and, as estimated by Dr. Rasmussen, we owe to him the investigation of 175,000 square kilometers of before unknown area.

In 1914 Macmillan in a four-year polar expedition sledged about 140 miles over sea ice northwest from Cape Thomas Hubbard on Axel Heiberg Land, and Ekblaw of his expedition surveyed parts of Ellesmere Land.

In 1903–1907 Amundsen in the *Gjöa* made the northwest passage in an easterly direction and visited and relocated the North Magnetic pole on Boothia Felix.

THE GREAT DANISH EXPLORERS

The great Danish explorers, Knud Rasmussen, J. P. Koch, Lauge Koch and Freuchen, come on the polar, and especially the Greenland, stage of exploration in the early part of the 20th Century. An earlier entry of the Scandinavians into Greenland exploration had dated, however, from the first quarter of the Eighteenth Century, when the missionary, Hans Egede, began religious work among the Greenland Eskimos and developed Greenland "colonies" along the west coast.

In 1906 there existed a great gap of over eighty geographical miles between Cape Bismarck near latitude 77° of the east coast and Wychoff Island, Peary's Farthest Southeast in Peary Land. The Danish Northeast Greenland Expedition of 1906–1908 under Mylius Erichsen through the

work of Hagen, the surveyor, corrected the map of Independence Fjord; and the gap in the coast was closed by the great sledge expedition of J. P. Koch after the death of the expedition leader. In 1910 Mikkelsen crossed the ice cap of the Northeast Foreland and further explored Independence Fjord.

THE DISCOVERY OF THE NORTH POLE

The year 1909 is notable for the achievement of the North Pole by Peary on his eighth expedition into the Arctic and after 23 years of strenuous polar exploration. The Pole was reached on the 6th of April of that year and was the culmination of more than three centuries of strenuous competition between the exploring nations of the world in which some 700 men had given up their lives. After many failures Peary succeeded through remarkable organization of a special supporting party system adapted to the shifting sea ice, and with favorable wind and weather after so much disappointment in this line. The polar area was found to be a deep sea like that nearer the coast, though this was found to be bordered by a continental shelf.

THREE GREAT TRANSECTIONS OF GREENLAND

The year 1912 was signalized by three outstanding Arctic expeditions, each of which accomplished a transection of the Greenland inland ice, and all of them within the broader sections. The Danish Expedition under J. P. Koch with Alfred Wegener as companion crossed from northeast to southwest, setting out from Cape Bismarck; while the Swiss Expedition under De Quervain traversed the area from northwest to southeast between Disco Island and Angmagssalik. Another Danish Expedition under Knud Rasmussen with Peter Freuchen as companion crossed North Greenland from Smith Sound to Independence Fjord somewhat south of the inner transection by Peary in 1895.

In 1917 with Lauge Koch as surveyor, Rasmussen mapped in some detail the fjords of the Greenland north coast and made in addition a new transection of the ice cap of Northwest Greenland. In his Fifth Thule Expedition covering the four years 1921–24 he traversed the entire north coast of British America from east to west, primarily for a study of the Eskimo tribes, but with contributions to the physical geography of the region.

THE NORTHEAST PASSAGE AGAIN

The Northeast Passage, first accomplished by Baron A. E. Nordenskiöld in the *Vega,* was again achieved by the Russian Hydrographical Expedition to the Arctic (Vilkitski Expedition) in the years 1914–15. This important expedition discovered Nicholas II Land northwest of the Taimyr Peninsula,

extending between latitudes 77½° and 81½° N. Though only the east and the south coasts were visited, the land was found to extend through eight degrees of longitude and appears to be at least as large as Svalbard. This expedition surveyed also the north and east coasts of the Taimyr Peninsula and the Siberian coast between the mouth of the Kolima River and Bering Strait.

In 1918–21 the *Maud* of Amundsen's Arctic expedition again made the Northeast Passage, and returning to Cape Chelyuskin carried out scientific studies off this stretch of coast. In 1932 the Northeast Passage was made by Schmidt, and is now almost an annual occurrence.

THE EAST GREENLAND COAST

In the modern mapping of Greenland no explorer has contributed so much as Lauge Koch, whose expeditions have covered the entire coastland of Greenland from Melville Bay on the west to Angmagssalik on the east. His independent expeditions have been carried out in the years 1920–23 (North Greenland), 1926–27 (East Greenland), 1929 and the "Three Year" Expedition of 1931–35 (East Greenland). The later of these expeditions have been greatly stimulated and supported through the rival claims of the Danes and the Norwegians to the East Greenland coast, which claims have played a part also in the initiation of a thorough triangulation and airplane survey of the South Greenland coastal area. The latter is in part completed and still in progress under the Danish Geodetic Survey directed by Nörland.

For their part the Norwegians have made expeditions under Hoel, especially in 1920 and 1931 to those parts of the east coast which were claimed by them before the adverse decision of the International Court. Two British expeditions to East Greenland have also been carried out by Wordie in the years 1926 and 1929, with important surveys.

The British Arctic Air Route Expedition under Watkins (1930–31) set up two stations in Greenland, one of them on the crest of the ice cap near latitude 67°, and the other on the east coast within the Angmagssalik district. Watkins was able to make a new transection of the inland ice near the 67th parallel (led by Rymill), and a traverse of it from Angmagssalik to Ivigtut in the extreme south near latitude 61° (led by Scott).

In the last two expeditions before his untimely death, the 6th and 7th Thule Expeditions of 1931–33, Rasmussen explored the difficult coast of southeast Greenland with the use of motorboat, and prepared an accurate modern map of the coastal area.

One of the greatest and most scientific of all Arctic expeditions was that under Alfred Wegener in the years 1929 to 1931, in connection with which correlated stations, especially for meteorological and physical studies were

established at *Mid-Ice* in the center of the ice cap near latitude 71°, on the ice cap also within the western border region, and at the east coast on Scoresby Sound. For the first time an accurately measured profile was prepared of the inland ice from its western border to *Mid-Ice,* and soundings to the rock bottom beneath the ice were carried out along this course. In 1931 Hoygaard and Mehren made a new transection of Greenland between latitudes 71° and 74°, in 1932 Belknap of the Fifth University of Michigan Expedition made a new penetration in latitude 74°, and in 1934 Lindsay a remarkable new transection and traverse of over a thousand miles between latitudes 66° and 70°.

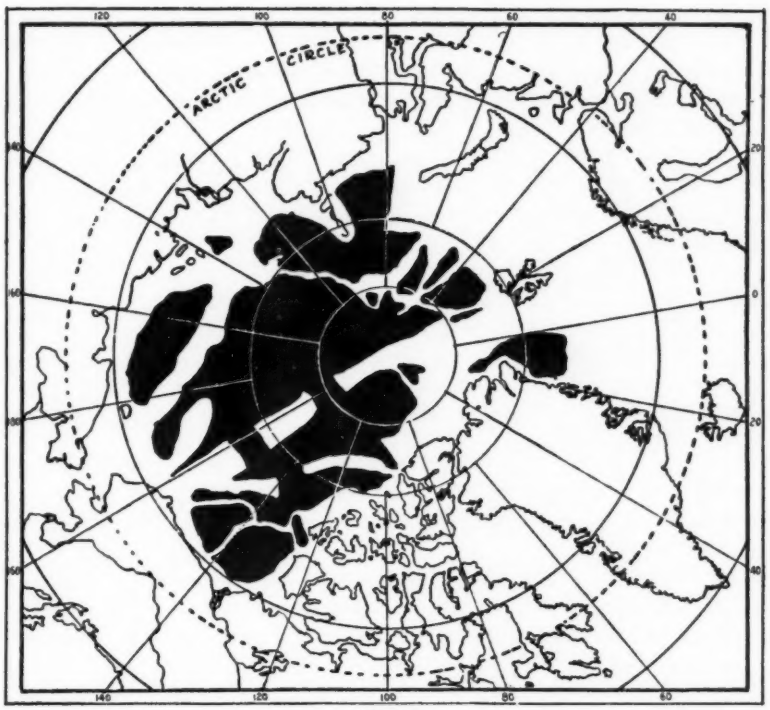
EXPLORATION FROM THE AIR

In the last decade the new method of exploration from the air has introduced great changes, and in some ways has greatly simplified the technique through removing the terrible handicap of inequality of surface. Wherever there is either a lack of snow cover or a diversity of rock and snow, the method meets all the desirable conditions for photo-cartographic work; but over a monotonous snow surface there is a lack of shadows, and therefore of character; and even with soundings from the plane through the air the method leaves much to be desired. For a thorough investigation the dog sled is still the best method of attack, except where the surface is sufficiently even for the use of either propeller tractors or, as it seems now, of tractors with surface traction. For the ice cap Ellsworth has now accomplished the demonstration of the long overdue practicability of ice-cap landings from a plane, and so has greatly enlarged the field of airplane exploration.

One of the first attempts to survey the Arctic by air method was the ill-fated one of Andrée in 1897 with the use of an uncontrolled balloon, the mystery of whose disappearance was cleared up by Gunnar Horn in 1930 when the bodies, diaries and other relics of the expedition were found on White Island. In 1909 Wellman with a dirigible balloon succeeded in flying over the Arctic pack ice from Spitzbergen (now Svalbard), a distance of some sixty miles. (Map 4).

The first airplane flights over Arctic pack ice appear to have been those of the Russian Nagurski, who in 1914 in the rescue of Sadov in two flights flew over the Barents Sea 200 and 70 miles respectively. In 1824 Binney of the Oxford Expedition used a plane with fair success to photograph and map areas of Northeast Land.

Larger attempts to use the plane in serious exploration were made in 1925. Byrd then made several flights over the fjord region west of Kane Basin and also over the Greenland ice cap near Cape York. In the same year Amundsen and Ellsworth flew in two Dornier-Wal planes from Sval-



MAP 4.—Main Present Unexplored Areas.

bard to within a degree of the North Pole, and were then able to rescue themselves after a forced landing only with the very greatest difficulty. A year later, in 1926, Byrd flew with Floyd Bennett to the North Pole by plane from Svalbard, and two days later Amundsen and Ellsworth flew in the airship *Norge* with Nobile as pilot from the same base over the Pole to Alaska.

Polar flying was now fully launched and in 1926 and 1927 Wilkins by plane made flights over the pack ice northward from Point Barrow, Alaska; and in the following year he made with Eilesen the remarkable flight by plane from Point Barrow to Svalbard through the American sector of the Arctic.

In 1928 Nobile also made the flight to the North Pole in the dirigible *Italia,* an expedition which ended in disaster and heroic rescue. All these flights by different routes greatly enlarged our knowledge of the Arctic

Sea, though they revealed no new land, and the flights were for considerable distances under conditions of limited or zero visibility. In 1930 Chokhowsky made survey flights over the unknown delta region of the Pyasana River and Mawdesly of the Canadian Arctic Patrol flew thousands of miles over Arctic territory.

In 1928 Hassell and Cramer attempted a flight across Greenland, flying from Rockford, Illinois, but lost their way, made a forced landing on the ice cap of West Greenland and were rescued by the University of Michigan Expedition from a station east of Holsteinsborg.

In 1931 Parker Cramer made another attempt and accomplished the first transaction by plane from the west coast to Angmagssalik, but perished in the North Sea while continuing his flight to Copenhagen. A month later von Gronau flew from Scoresby Sound southwestward across the ice cap of Greenland to Sukkertoppen on the west coast. In 1933 Lindbergh made flights along the coast of South Greenland and also made a transection in the latitude of Disko Island.

AREAS STILL UNEXPLORED

There remain today two large Arctic areas which are still unexplored even by reconnaissance. These lie largely within the East Siberian sector of the Arctic and in the Alaskan sector. They might perhaps be regarded as one, since the *Norge* flight, whose track divides them, was for considerable distances made under conditions of zero or of poor visibility. The first mentioned and larger of the two areas is bounded by the tracks of the *Jeannette* in 1879–81, of the *Fram* in 1893–95 and of the *Norge* in 1926. The other and smaller area, but large enough to include the British Isles, lies between the track of Peary to the Pole in 1909, of Wilkins in his flight Alaska to Svalbard in 1928, and the *Norge* track of Amundsen and Ellsworth in 1926. Other areas still unexplored and nearly as large as the smaller of these two are to be found within the Siberian sector of the Arctic.

Such areas of the Arctic Sea are enveloped in mists for so much of the warmer season of the year that the best approach is by plane in the late winter or very early spring before there is water upon the ice and when leads close quickly in the low temperatures. The submarine especially designed for polar exploration, which is a plan of Wilkins, with more time at its disposal seems ideally suited for exploration within these areas. Crocker Land of Peary probably lies within the smaller of the two areas specially mentioned, and its discovery is likely to be either from plane or submarine.

University of Michigan,
December, 1936.

Regions of Manufacturing Intensity in the United States

HELEN M. STRONG

Varying usage as to the meaning of "manufacture" divides into four periods. From its earliest use in 1621, until 1754, manufacturing meant only hand work. Between 1755 and 1802 usage broadened but the words "machine" and "machinery" do not appear. From 1803 to 1898 it means both hand and machine work, and dictionaries continue to define it thus. Since 1898 it has meant, in the popular mind, producing by machinery.[1]

Since 1860 large-scale factory production has been conspicuous in the manufacturing industry of the United States. During the decade 1890–1900 manufacturing began to assume its present-day characteristics, and to compete in international trade. The Census of 1900 for the first time separated hand work from machine production, revealing that less than 10 per cent of the total value of manufactured products was turned out by hand. Since then household industries have not been enumerated by the Census.[2]

The 1930 Census classifies a bewildering multiplicity of thousands of manufacturing lines into 326 industries, and 16 industry groups.[3] The regional distribution of these manufactures is the subject of this study.

A UNIQUE REGIONAL PATTERN

The manufacturing industry in the United States has formed a regional pattern over an area of about 3,000,000 square miles, without having been shaped by custom tariffs, subsidies, and other pressures, political in origin, such as have moulded the manufacturing pattern of Europe. Therefore, it would seem to exemplify spontaneous regionalism of great geographic significance. There probably is no country of comparable extent, where the manufacturing pattern has evolved spontaneously in response to the influence of natural resources as has that in the United

[1] The dates refer to dictionary definitions:

Cf. Census Reports, *Twelfth Census of the United States* (taken in 1900), Manufactures, Part I, United States by Industries, p. xxxv. Washington U. S. Census Office, 1902.

Vol. VII, Bouvier's *Law Dictionary,* Student's Edition, 1928, edited by William Edwin Baldwin, New York, p. 753. Banks Law Publishing Co. 1928.

Law Dictionary, James A. Ballentine, p. 792. Rochester, Lawyer's Cooperative Publishing Co., 1930.

[2] *Twelfth Census, cit.,* Manufactures, Pt. I, pp. xlviii, xlix, lv.

[3] *Fifteenth Census of the United States, 1930,* Manufactures, 1929, Vol. I, pp. 3–4. Washington, 1932.

States. Although there have been certain economic factors such as freight tariffs and deliberate concentration of some manufacturing in given areas, there has been, on the whole, freedom of movement from place to place in the country, absence of tariff restrictions such as cut across many foreign countries, and of other artificial controls which tend to obscure the influence of the geographic factors. Consequently, for the geographer, study of the regionality and delimitation of the regional intensity of manufacturing in the United States presents a geographic problem of unusual appeal.

Evidences of this regionalism appear in the published statistics of the 1930 Census of Manufacturing. These show that, concentrated within 94,000 square miles are nearly half the population of the country, three-fourths of the wage earners, and 78 per cent of the value of manufactured products. The available figures, unfortunately only by counties which give too large an areal unit and which vary in size, show 33 industrial areas, each with an important manufacturing conurbation as its nucleus, in which 40,000 or more wage earners were employed in 1929. Thirty of these lie north of the Ohio-Potomac rivers and east of the Missouri River. The three others are on the Pacific Coast.[4]

A yet more intensive concentration of manufacturing, in scattered areas and larger agglomerations, probably will be revealed if and when statistics are available by minor civil divisions. However, the geographic, economic, and social significance of the regional distribution of the manufacturing industry justifies an exploration with the data now available.

Because of the limitations presented by published census data, which, according to law must avoid disclosing the operations of individual industries, these published data tend to present a picture of greater concentration than exists in fact, since counties with only a few plants, even though these are of major proportions, are grouped under "all other counties," and thus conceal in large degree the dispersed character of industry. This situation is probably responsible in part for the emphasis in numerous studies upon the concentration of industry in a few great manufacturing centers, and for the apparent overlooking of the wide dispersion of important manufacturing industries throughout the country. A careful analysis of all the census tabulations, published and unpublished, reveals that manufacturing activities of major rank are situated from the Atlantic to the Pacific, and from the Canadian border to the Gulf, in both agglomerated and detached location.

[4] *Fifteenth Census, cit.,* Manufacturers, 1929, Vol. III. Each Industrial Area comprises the county in which the city or cities are located, together with any adjoining county or counties in which there is great concentration of manufacturing.

MANUFACTURING, AND MINES, FARMS, AND FORESTS

There have been numerous studies of the manufacturing centers of the United States such as those of Hartshorne and De Geer, as well as those relating to the localization of industry,[5] but the present investigation, in contrast to these other studies, aims to outline the regions of contrasting manufacturing intensity and characteristics for the United States as a whole, by taking into consideration all types of manufacturing.

Conspicuous in American manufacturing by their nature and use have been the iron and steel centers. Blast furnaces, steel mills, other steel using industries, the copper working industries, and some others, have provided the fabric out of which American invention has developed transportation, communication, and, in considerable measure, the Ameri-

[5] The following is a selected bibliography taken from a survey of the subject recently made by the author:

Richard Hartshorne: "A New Map of the Manufacturing Belt of North America," *Economic Geography,* 12, (1936), pp. 45–53.

Sten De Geer: "The American Manufacturing Belt," *Geografiska Annaler,* 1927, pp. 233–259.

U. S. Census, *Location of Manufactures in the United States,* 1899–1927. Washington, 1929.

Edmund E. Day and Woodlief Thomas: Growth of Manufactures 1899–1923, *U. S. Census Monograph No. 8,* Washington, 1929.

T. B. Manny and W. C. Means: Rural Factory Industries, *U. S. Department of Agriculture, Circular No. 312,* April, 1934.

H. H. McCarthy: Industrial Migration in the United States, 1914–1927, *Bulletin of the University of Iowa.*

Industrial Development in the United States and Canada, 1926 and 1927, a cooperative survey of the Civic Development Committee of the National Electric Light Association and the Policyholders' Service Bureau of the Metropolitan Life Insurance Company.

Daniel B. Creamer: Is Industry Decentralizing? *Studies in Population Redistribution, Bulletin No. 3.* Philadelphia, University of Pennsylvania Press, 1935.

Malcolm Keir: 'Economic Factors in the Location of Industries," *Annals of the American Association of Political and Social Science,* 97, (1921), pp. 83–92.

Census Reports, *Twelfth Census, cit.,* Vol. VII, Manufactures, Part I, United States by Industries, prepared under the supervision of S. W. D. North, Chief Statistician of Manufactures, pp. cxc–ccxiv, ccxviii–cccxiv. Washington, 1902.

U. S. Census (Joseph D. Lewis, Chief of Division): *The Localization of Industries,* Manufactures, 1905, Pt. I, The United States by Industries, pp. ccxxviii–ccxlii. Washington, 1907.

Edward A. Ross: "The Location of Industries," *Quarterly Journal of Economics,* 10, (1896), pp. 247–258.

Alfred Weber's Theory of the Location of Industries, English translation, with introduction and notes by Carl Joachim Friedrich, Chicago, University of Chicago Press, 1929.

W. Cunningham: "The Localization of Industry," *Economics Journal* (Journal of the British Economic Association), 12, (1902), pp. 501–506.

can standard of living. But there is another and no less significant phase to American manufacturing.

Agricultural and forest products provide the raw materials for a large share of American manufactured products. According to the 1930 census, 23 of the 38 manufacturing industries employing more than 50,000 wage earners depended upon the farm and the forest rather than the mine for the goods they fabricated, and accounted for half the value added by manufactures in this group.[6] Some of these factories are located inconspicuously in smaller centers, near the farm and forest, others of significance are situated in larger centers. For example, canning and preserving usually is carried on close to the fruit and vegetable producing areas, while flour milling is widely distributed throughout the country both near to and far from the wheat fields. Many small towns sell only the local brands of flour, despite the country-wide markets for the great milling centers such as the Twin Cities, Chicago and Buffalo. This widely dispersed aspect of manufacturing in the United States together with its far-reaching and basic dependence upon agriculture and forestry calls for careful study in any future consideration of American manufacturing, regional or otherwise.

Each manufacturing region possesses elements of manufacturing homogeneity within itself which set it off, by contrast, from surrounding regions. Its regional genesis has been through bonds of economic, geographic, and social factors which have tended to evolve for the various manufacturing activities within its borders a similarity, and in some cases a mutuality of interests and activities.

For example, textile, metal-working, and chemical industries of the Boston-Baltimore region have located where fuel, raw materials, and transportation to markets unite to afford the atmosphere in which they may prosper. This area of dense development follows river and lowland highways near the coast, and extends only to the eastern margin of the rough Appalachian country. It is marked by emphasis upon metals, fibers, and chemicals, with only comparatively small amounts of food manufactures. Progressively westward toward the agricultural lands of the Middle West, food products become of increasing importance in the manufacturing scheme. This gradual emergence of food manufactures and those utilizing agricultural products is apparent in the Buffalo-Mohawk area, in that extending from Cleveland to Pittsburgh, in the region along the southern Piedmont, and in the South. Even in the Northeast

[6] See chapter by the author: "Conservation of Natural Resources and the Manufacturing Industry," in *Our Natural Resources and their Conservation*, pp. 475–483. New York, John Wiley & Sons, 1936.

Fifteenth Census cit., Manufactures, 1929, Vol. II, p. 34.

where metals and machinery are conspicuous in the manufacturing industry, the new development in utilization of plastics and synthetic products is bringing agricultural products into many industries in large quantities, but the finished product may reveal no hint of its farm origin.

In Chicago and vicinity agricultural products occupy a large place in the manufacturing fabric, become almost the sole reliance for the factories of the Mississippi Valley, and appear as predominant elements from the Mississippi River to the Pacific Coast.

Manufacturing is as distinctly an outgrowth of the physical resources of the country as is agriculture, and its location and regional distribution has been as closely influenced by fostering or retarding physical conditions as has that of agriculture. The raw materials, the sites on which factories and groups of factories have located might be termed the soil and topography of manufacturing, for they provide its tangible physical conditions. But there are other equally, and perhaps more potent physical factors that have functioned silently in the location and regional distribution of the manufacturing industry. Like climate for agriculture they are intangibles and abstractions, but future analyses may reveal them as the most significant elements in locating prosperous manufacturing regions. It remains for someone to evolve a device for isolating, measuring, and recording the forces in transportation advantage; relation to markets and raw materials; the influence of climate itself on the economic life of a region, which may render it favorable or unfavorable for manufacturing activity, the significance of power to a given area; the immediate or more remote market potentialities, the bonds of common physical advantage, and the elements of advantage in a given area not found outside its bounds. During the spread of settlement over the country manufacturing activities developed in many places only to wither and disappear, while in other places these same activities prospered.[7] Possibly those that failed to become permanent may, by way of contrast, indicate some of the constructive elements in the development of the manufacturing regions that *have* established themselves.

DISTINCTIVE PATTERNS—EAST AND WEST

The comparative continuity of more or less highly developed manufacturing regions from the Red River of the North, Kansas City and Dallas eastward, as compared with the sparse distribution west from this line, presents a problem whose analysis may reveal some basic relations between geographic factors and human development (Fig. 1). Within this area to the west there are minerals and rich agricultural lands,

[7] Kemp, Harold S.: "Buffalo, 'Queen City of the Lakes'," in *Journal of Geography* 30(1931), pp. 93–110.

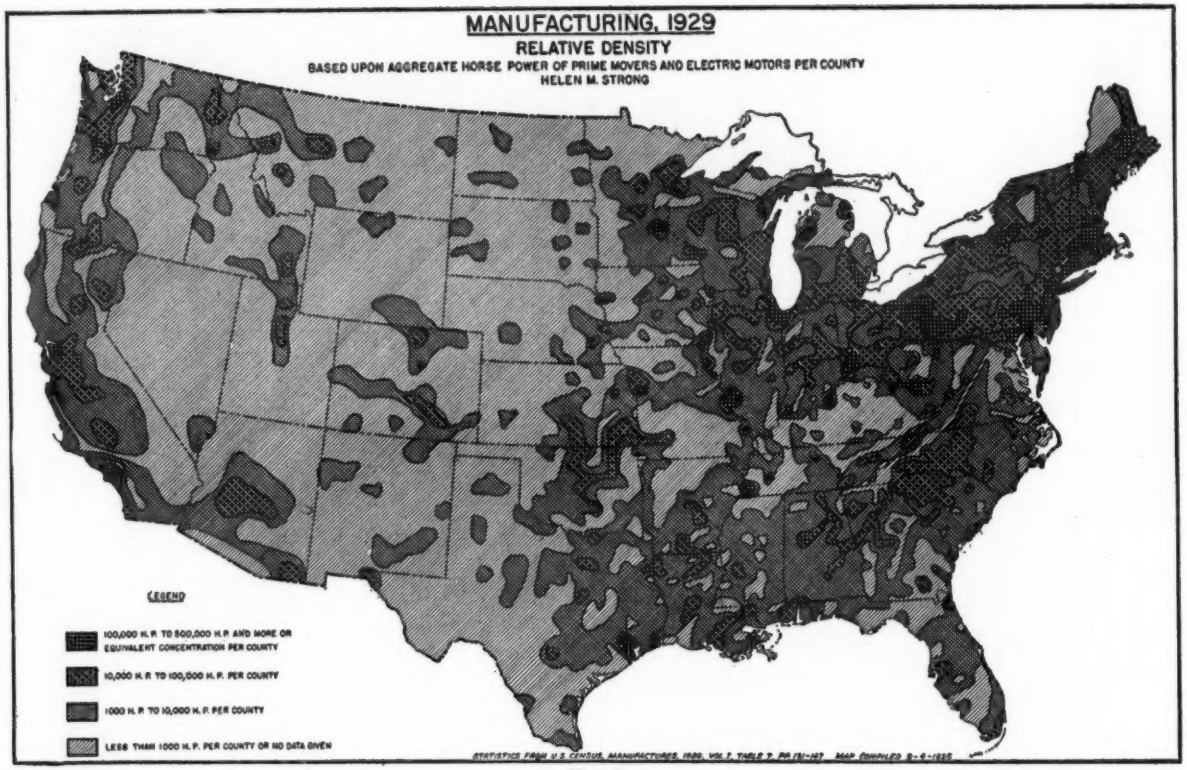

MANUFACTURING, 1929
RELATIVE DENSITY
BASED UPON AGGREGATE HORSE POWER OF PRIME MOVERS AND ELECTRIC MOTORS PER COUNTY
HELEN M. STRONG
LEGEND
100,000 H.P. TO 500,000 H.P. AND MORE OR EQUIVALENT CONCENTRATION PER COUNTY
10,000 H.P. TO 100,000 H.P. PER COUNTY
1000 H.P. TO 10,000 H.P. PER COUNTY
LESS THAN 1000 H.P. PER COUNTY OR NO DATA GIVEN

FIG. 1

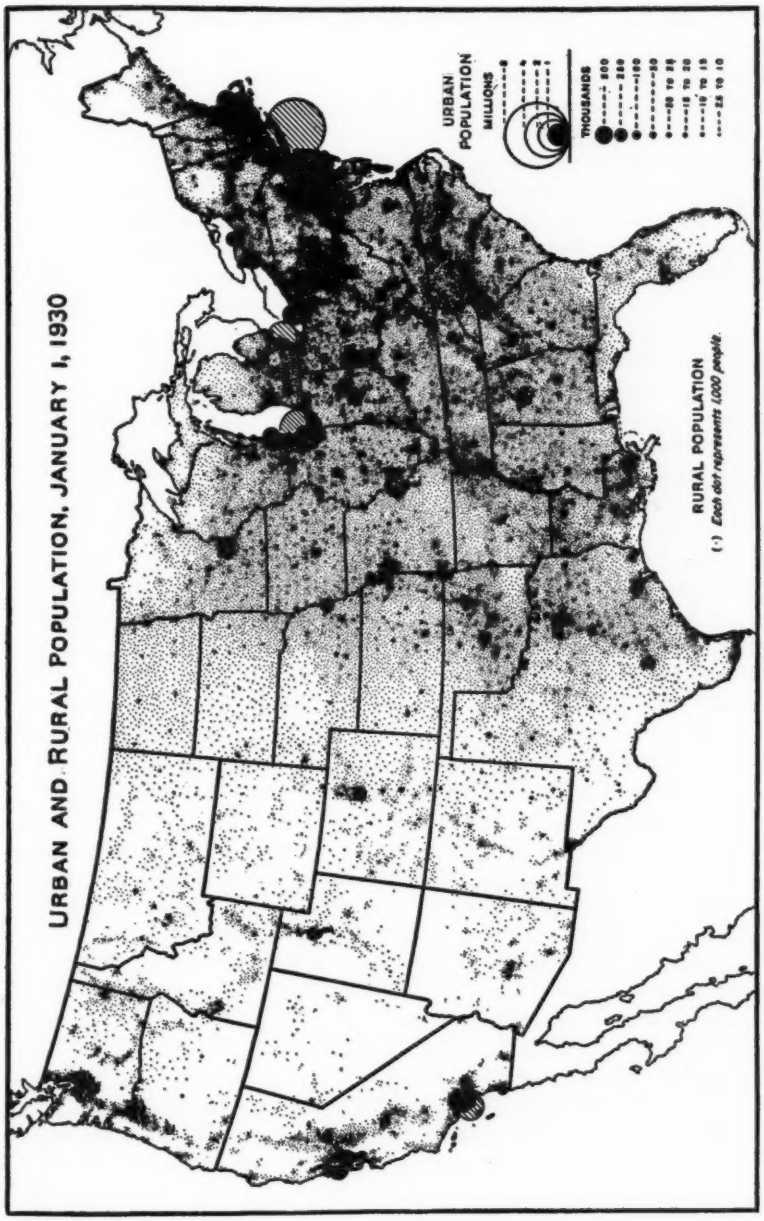


FIG. 2

U. S. Dept. of Agriculture, Bureau of Agricultural Economics

forests and water, but population continues sparse and manufacturing sparsely spotted over the area. The natural land units in the plains are blocked out on so large a scale, and with such evenness of surface between streams and drainage channels, that the land surface itself failed to offer topographic directiveness broken up into small enough units to concentrate flow and settlement of population in many places within convenient reach of each other. Added to this is low rainfall unevenly distributed throughout the year, and differing in amount from year to year.

Beyond are the Rockies with their vast sweeping slopes, high valleys, long distances, and rugged topography, where growing seasons are short in many places and soils thin or stony. Between these and the more populous Pacific Coast are the vast arid and semi-arid regions.

Scattered throughout these vast areas of plains, mountains, and dry lands are manufacturing activities growing out of farming, grazing, orchard, or mine. Locally, wheat is ground into flour to be consumed relatively close by. Apples, pears, oranges, and other fruits are canned and preserved. Wool is woven into blankets or other materials. But these and many other manufacturing industries with either local or nation-wide distribution are scattered far apart and related closely to the local agriculture, timber, or mineral resources. The land pattern and the climate under present economic conditions severely limit the number of people who may make a living in this region, and therefore the growth of a closely spaced manufacturing life. Factories are numerous only where people are numerous to provide labor and consume their products (Fig. 2). And this latter condition probably never can be met in the land between the longitude of the great southern bend of the Missouri River and the Pacific Coast regions. Physical conditions indicate that it will be primarily a land devoted to raising of crops and livestock, and from which minerals and timber will be taken.

In most of the western portion of the United States, distance has tended to place a scattered and relatively sparse population and scattered manufacturing centers. The element of distance is a handicap within the area: distance between points at which the lay of the land causes travel routes to cross or to impinge upon a concentration of physical advantage or resources; distance across the larger natural units into which the land divides. Distance from regions of greater manufacturing density is a further handicap. The West is remote from the Pacific Coast region, where there is opportunity for contact with the outside world, and where large areas are suited by climate, soil, and other natural resources to more intensive agricultural use, manufacturing development, and therefore to a larger and more dense population. It is equally re-

mote from the whole humid eastern portion of the United States, an area of fertile soils, large areas of fairly level land, and accessibility either by lowland routes along river valleys or through easy passes in wooded, but low, mountain ranges. In the West agricultural products, fuel, mineral resources, and timber either are available or may be assembled at strategic locations, so that all industries may blend into the complex which has stimulated development of a larger population characterized by many dense conurbations. Yet, despite handicaps of distance, many of the manufacturing centers of the West, though smaller than many in the East, are equally significant in their local relations and in coordination with the industrial life of the country as a whole.

DELIMITATION OF REGIONS OF MANUFACTURING INTENSITY

Many difficulties present themselves in the making of such an analysis. Published statistical data in one industry or another or for all industries are lacking for many parts of the country. Statistics when available are given, some for cities and some for counties. Counties vary in size from a few square miles to several thousand square miles. Each set of statistical material falls short in one way or another. If number of wage earners were to be used, some industries high in value of products would be represented by only a few wage earners. Value of products contains many duplications, because it includes all the raw and processed materials which have gone into the making of these products, and these are included in other categories also. Value added by manufacture represents a money value, but industries comparatively low in value may employ many wage earners and be of great significance in the economic scheme. Horsepower of prime movers and electric generators driven by purchased energy also may show low horsepower for an important industry, but, on the whole, it reveals the regional structure of the relative density of manufacturing in the United States. Therefore it has been used in the present study.

The statistics for horsepower are available by counties only, as is true of all other figures, and so are open to the objection of covering areas differing in size with no means of reducing them to comparability. When statistics are provided by minor civil divisions (such as townships), there will be an opportunity to make a real isopleth map of manufacturing density for the United States. However, the importance of obtaining in the concrete some degree of realization in regional terms of the relative manufacturing density from place to place in the United States makes it worth while to begin to analyze the problem with the data at hand.

The chief factors considered in transforming the map of relative

manufacturing intensity (Fig. 1) as shown in published and unpublished Census data for horsepower (of prime movers and electric generators driven by purchased energy) into a regional map of manufacturing intensity were: (1) the intensity and continuity of the manufacturing development over a given area; (2) the physiographic location and limits of an area; (3) the areas having little manufacturing; (4) the interrelationship, economic and otherwise, between manufacturing centers and/or diffused areas of manufacturing.

The purpose was to regionalize the manufacturing fabric of the country. "Manufacturing fabric" means all manufacturing—that based on agriculture and agricultural food and feed products and fisheries, as well as that growing out of the mineral and forest resources. This point of view makes the broad question of manufacturing regionalization paramount, because thought is not confined solely to localization of individual industries, or to dense concentrations of industrial activities such as steel and textiles. In drawing regional boundaries, it was realized that, for this as for every other type of region, boundaries are arbitrary devices, for, in most places there is no actual boundary line, but rather a gradual gradation from one condition to another.

Manufacturing by its very nature is an intensive but spotty use or coverage of the land actually occupied, in contrast to agriculture which uses broad areas of land and covers it with a continuous series of farms. Manufacturing regions may be composed of rather closely spaced manufacturing centers or they may be made up of somewhat widely separated manufacturing centers united into one region by common characteristics or common interests. Manufacturing activities of many different kinds may blend to produce a regional manufacturing mosaic, or a single manufacturing activity such as canning or textiles may dominate.

Within a manufacturing region the land area not covered by factories, canneries, or mills may be larger than that occupied by them. Because manufacturing has a dispersed location in so many places, the problem of delimiting regions of manufacturing intensity becomes a different one from that of outlining agricultural regions.

THE BASIS OF THE CLASSIFICATION

In broadest regional terms, on the basis of horsepower of prime movers and electric generators driven by purchased energy for counties, the country divides (Fig. 1) into three great regions: that in the eastern part from Texas northward and eastward to the Atlantic where there is an almost continuous net of counties with 1000 or more horsepower each; the Pacific Coast with also an almost continuous strip of 1000 horsepower

or more per county; and the intervening spaces of the Great Plains, the mountains and interior basins where, even in counties of large area, except in a few places, there is less than 1000 horespower per county for prime movers and electric motors driven by purchased energy.

On this background have been outlined seventeen manufacturing regions (Fig. 3) where there is moderate or more than moderate manufacturing development; twenty-six regions showing high manufacturing density; and fourteen with, in general, only sparse manufacturing distribution. The manufacturing regions of moderate or more than moderate developments are: The Northeast, Great Appalachian Valley, the South, Florida, Industrial Middle West, Agricultural Middle West, Upper Mississippi Valley, East Dakota, Great Plains Railroad Division Points Areas, Rocky Mountain, Piedmont, Salt Lake-Idaho, Northern Rocky Mountain, Cascade Irrigated Valleys, Pacific Northwest, San Francisco-Great Valley, Southern California, and the Southwest. The regions of sparse manufacturing (Figs. 3 and 4) are: Maine Pinewoods, Adirondack, North Atlantic, Blue Ridge, Everglades, Georgia-Florida Flatwoods, Ozark-Allegheny, Northern Cut-Over Lands, Great Plains, Great Basin-Rocky Mountain, Cascade Mountains, Olympic Mountains, and Mountain (in Southern California). Those of high manufacturing density are: Bangor, St. Lawrence, Buffalo-Mohawk, Boston-Baltimore, Cleveland-Pittsburgh, Detroit-Toledo, Chicago, Cincinnati, Columbus, Kanawha, Indianapolis, Louisville, Nashville, Southern Piedmont, Fall Line Areas, Twin Cities, St. Louis, Memphis, Port Arthur-Houston, Kansas City, Puget Sound, Cowlitz-Willamette, Sacramento-San Joaquin, Los Angeles, Dallas-Fort Worth, New Orleans.

EASTERN UNITED STATES

The Northeast Manufacturing Region is characterized by the most continuous intensive manufacturing development and the largest areas of the greatest manufacturing density, 100,000–500,000 horsepower and more. Its northern and eastern boundaries are established by the Great Lakes, the international boundary, and the sea, except in northern Maine, and where it meets the resort areas of southern Maine, Cape Cod, eastern Long Island, and the New Jersey shore. At the south it touches the agricultural areas of Delaware, Maryland, and Virginia, the Great Valley Manufacturing Region, the Allegheny Region of sparse manufacturing. The western margin was defined partly by the termination of the densest continuous Ohio manufacturing area, and partly by the line of tension between the area dominated by New York, Pittsburgh, Cleveland, and Detroit, and the region where the influence of Chicago, St. Louis, and

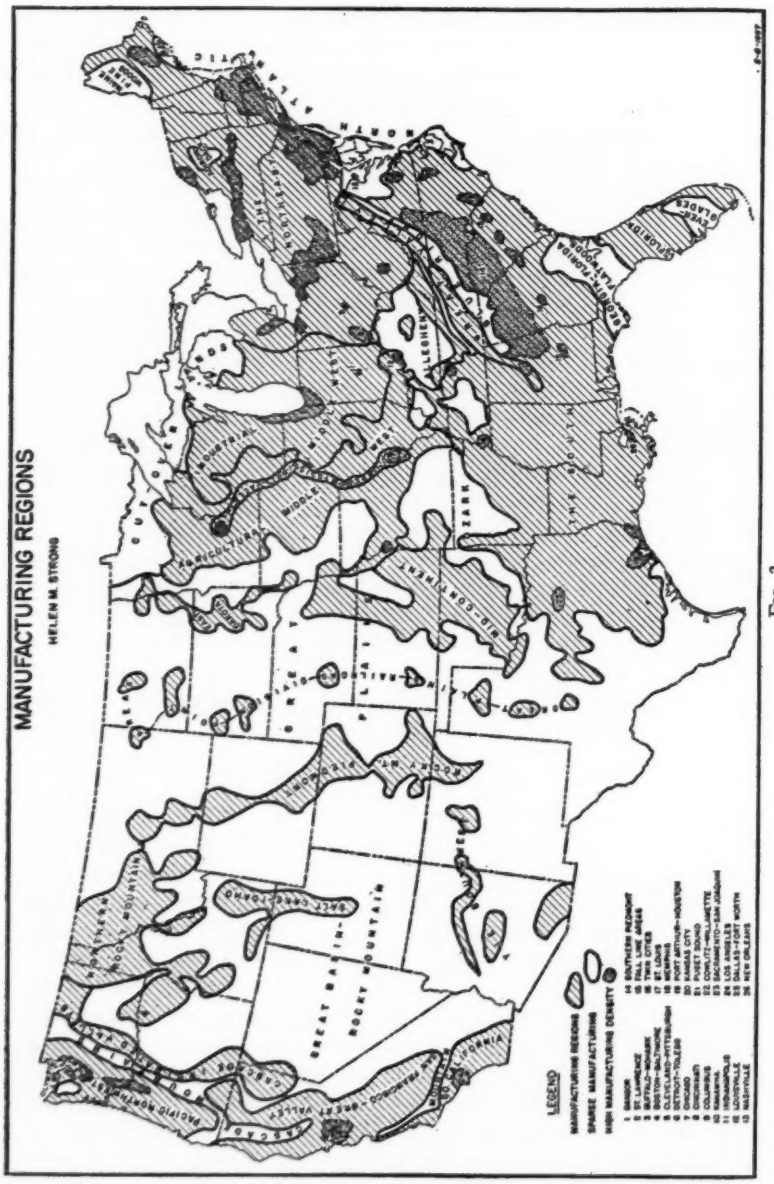

MANUFACTURING REGIONS
HELEN M. STRONG
LEGEND
MANUFACTURING REGIONS
SPARSE MANUFACTURING
HIGH MANUFACTURING DENSITY
1 BOSTON
2 ST. LAWRENCE
3 BUFFALO-MOHAWK
4 BOSTON-BALTIMORE
5 CLEVELAND-PITTSBURGH
6 DETROIT-TOLEDO
7 CHICAGO
8 MILWAUKEE
9 COLUMBUS
10 OMAHA
11 LOUISVILLE
12 INDIANAPOLIS
13 NASHVILLE
14 PIEDMONT REGION
15 MILL TOWN AREAS
16 TWIN CITIES
17 ST. LOUIS
18 KANSAS CITY
19 PORT ARTHUR-HOUSTON
20 DALLAS CITY
21 DENVER
22 CONCRETE-WHEAT
23 SACRAMENTO-SAN JOAQUIN
24 LOS ANGELES
25 PUGET SOUND
26 NEW ORLEANS
NORTH ATLANTIC
NORTH CENTRAL
SOUTH
GREAT PLAINS
ROCKY MOUNTAIN
PACIFIC

FIG. 3

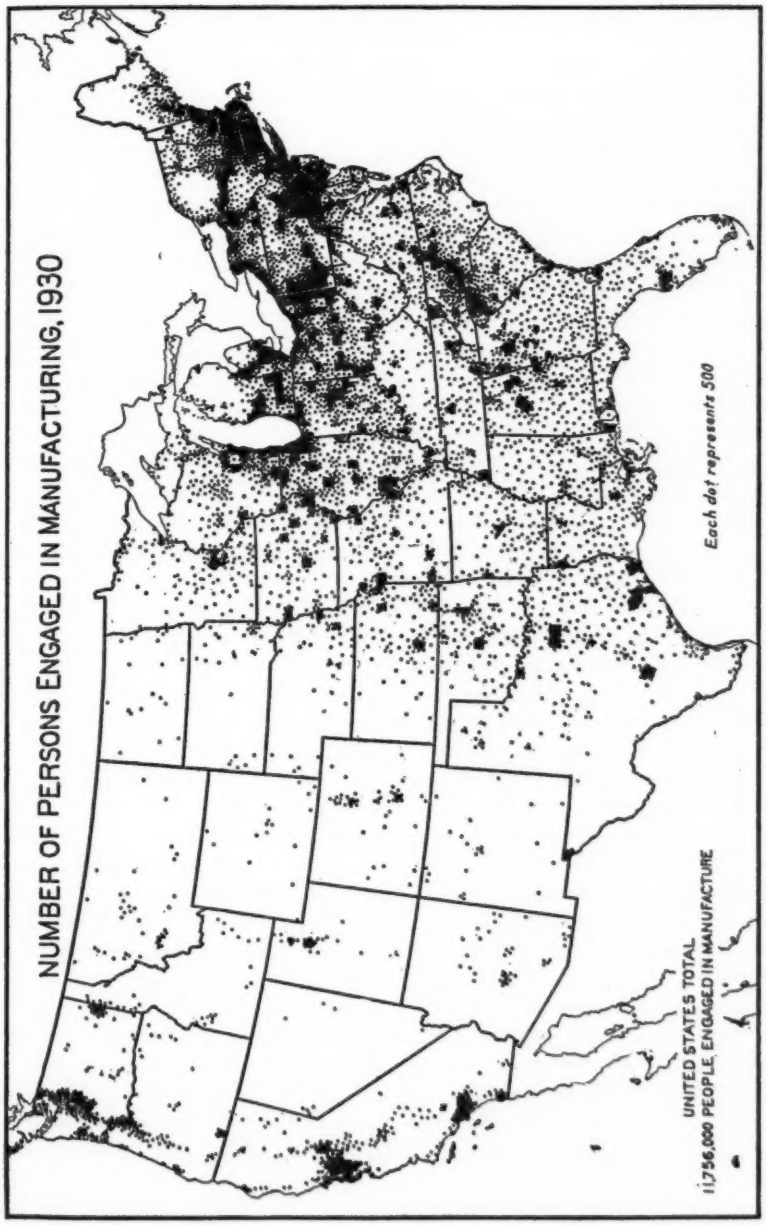

NUMBER OF PERSONS ENGAGED IN MANUFACTURING, 1930
Each dot represents 500
UNITED STATES TOTAL
11,756,000 PEOPLE ENGAGED IN MANUFACTURE

FIG. 4

U. S. Dept. of Agriculture, Bureau of Agricultural Economics

Minneapolis prevails. Here Appalachian and Illinois coal provide much of the power.

The areas of greater manufacturing intensity spaced along the Great Appalachian Valley indicate the unity of that area and, along with its physiographic entity, were the foundation for outlining it as a region.

The South stands out clearly from the North and East, separated from them by the Blue Ridge, Allegheny, and Ozark Regions of sparse manufacturing. It is characterized by continuous areas of more than 1000 horsepower, conspicuous in which is the broad band of high manufacturing density along the Southern Piedmont. Today this is the largest manufacturing region in the South, and obtains its power from coal and water. However, the latter source is being steadily cut down by silting of the resrvoirs behind the dams which supply the head of water for generating electric power. Consequently these provide power in many cases for only a few hours each day, necessitating use of coal the rest of the time. In this region conservation of the soil and prevention of erosion on farm and forest land has become a major concern for the manufacturing industry.

Other manufacturing centers of high density in the South are those such as Dallas-Fort Worth and the centers which have developed in the past where streams cross the Fall Line.

The Middle West has been divided into two manufacturing regions: the Industrial Middle West, and the Agricultural Middle West. The Industrial Middle West is characterized by almost continuous areas of high manufacturing activity. It includes the Chicago area with 100,000 to 500,000 horsepower and more per county. For raw materials its industries utilize iron, steel, and other metals; grain, fruits, and vegetables; and the textile fibers. Its manufacturing is a conspicuous economic activity. In contrast to this the Agricultural Middle West shows more separate and localized manufacturing areas. Products of agriculture and services to agriculture in large measure color its industries. Manufacturing and agriculture alike contribute to the general economic atmosphere.

The Mid-Continent Manufacturing Region divides from the Agricultural Middle West in the vicinity of Kansas City. The petroleum wells of the Mid-Continent Oil Field, the range and the cattle, wheat lands, and lead and zinc mines have been factors in its development.

A group of manufacturing areas has developed in the Red River and Sioux River Valleys to form what may be called the East Dakota Manufacturing Region. Here cream comes to cream depots to be made into butter. Grain is ground into flour. Cattle are slaughtered. Construction and repair shops service the railroads. Bread and bakery goods are made

for town and farm communities. The region draws its raw materials from the surrounding agricultural districts, and serves both them and more distant localities.

In the upper Mississippi Valley or the "Mississippi Trench" has evolved a clearly defined manufacturing region. Towns may be found where stream valleys enter the broad Mississippi lowland, and especially where valleys from uplands on both sides of the river merge at the same point, as at La Crosse. Dairying has prospered on the fertile bottomlands, and creameries and milk canneries are to be found in the towns. Flour mills and feed mills also are located in these places, and automobile industries that service the surrounding country. This "Trench" is an obvious feature for it presents a contrast to the uplands in its manufacturing development, its agriculture, and its physiography and soils.

WESTERN UNITED STATES

The string of manufacturing centers using 1000 to 10,000 horsepower extending north and south over the Great Plains appears conspicuously on the map of relative manufacturing density (Fig. 1). These are towns which have grown up at railroad division points on the plains, and where railroad construction and repair shops were established. Other activities gravitated to these transportation points, until they now serve their localities much as do those in the East Dakota Region. For want of a better name, they have been called the Great Plains Railroad Division Point areas.

From time immemorial, towns have developed where mountain pass highways lead out onto Piedmont plains. Such a group has developed in Denver, Pueblo, El Paso, Cheyenne, and other places along the Rocky Mountain Piedmont. They serve the mountain lands and the plains, drawing raw materials from both places. Here iron and steel, butter, meat packing, aluminum, car construction and repair shops, flour mills, jewelry, motor vehicles, rubber tires, coffee and spice grinding, piano manufacturing are woven into the manufacturing fabric, to provide the plains to the east and mountains to the west with needed products. Together these centers form the Rocky Mountain Piedmont Manufacturing Region.

The Salt Lake-Idaho Manufacturing Region has developed about the water supply for irrigation in the Utah oasis at the foot of the Wasatch Mountains, from that of the Snake River Valley, and out of the mineral wealth of the area. Its manufacturing is characterized by activities based on the crop and range agriculture, the minerals, and the cultural needs of the people. Making of butter, canning and preserving fruits and vegetables, production of condensed and evaporated milk, flour milling, meat packing, sugar beet refining, printing and publishing, copper smelting, foundry and

machine shop products, are important industries.

In the Northern Rocky Mountains south of the Canadian border, timber, minerals, fertile valley soils, and water power from the Rockies have contributed to development of the Northern Rocky Mountain Manufacturing Region. Here are located such centers as Spokane, Butte, Great Falls, Deer Lodge, Boise, and Pendleton. Manufacturing is based on local products. Copper, lead, and zinc are smelted; flour is milled; beet sugar refined; fruits and vegetables are canned; meat packing carried on; foundry and machine shop products and paper are manufactured; and wool from sheep raised in the region is woven into cloth and blankets. Here also steam railroad companies do considerable construction and repair work in their shops.

A series of irrigated valleys is situated along the eastern slopes of the Cascade Mountains. Melting snows supply water for irrigation. Warming Chinook winds bring an early spring. The sunshine ratio is high in the dry climate. Fruit and vegetables grown here are canned and preserved, as well as shipped away fresh. Flour is milled from local wheat. Its manufacturing is, in large degree, the outgrowth of irrigated agriculture based on soil and climate and transportation to eastern markets. This has been called the Cascade Irrigated Valleys Manufacturing Region.

A manufacturing region growing out of the climate, the soil, the minerals, and the drainages and rivers of the Southwest has spread over a few separated areas in the region so named. The warm continuous sunshine and constant supply of water from the irrigation ditches which find their ultimate sources in the natural reservoirs of the yellow pine forests on the mountain summits, and which have been impounded in larger and smaller reservoirs at Roosevelt, Coolidge, and Elephant Butte Dams have made possible semi-tropical agriculture. Fruits and vegetables locally grown are canned and preserved as well as packed fresh. The natural ranges of this semi-arid region have in past years provided rich forage for sheep and cattle. The former yield wool for weaving of rugs and blankets, and both furnish meat for local meat packing establishments, while the latter supplies milk and cream for dairy industries. Larger and smaller towns along the Salt and Gila Valleys and that of the Little Colorado have developed in these natural valley ways where tributary valleys or drainages have centered routes, or where there was a considerable extent of land level enough for cultivation. In southeastern Arizona copper is responsible for a smelting and refining industry. Over in New Mexico around Albuquerque another area has developed in the Rio Grande valley where a western tributary of that stream leads toward the headwaters of the Little Colorado, making Albuquerque a crossroads of natural travel routes north-and-south and east-and-west.

There is another manufacturing industry in this region which, taken as

a whole, it is safe to say bulks not at all small in value of products and quantity of output. It is not listed in the Census of Manufactures because it is a home industry. Since the early days of Spanish settlement rugs have been woven on home looms in small ranch houses and in every small settlement around the head waters of the Rio Grande. These settlements are more numerous than the sparsely populated character of the country would lead one to believe. They are situated in small mountain valleys, near level spots along the streams where irrigation ditches can take off. Many of these are less than fifty acres in extent, but they provide the crops for twenty or thirty families. In the old days all the wool came from their own sheep grazed on the rich native grass of the range, but, so severe is the denudation of the range due to overgrazing that it now is difficult in many places for these descendants of the early Spaniards, who, by the way, yet wear their large black Spanish hats and speak Spanish as their daily language, to find forage for their flocks. A few have their own flocks and make their blankets from the wool they have carded and spun for themselves, but many of the blankets are made from yarn purchased in quantity from Ohio and other places.

Blankets likewise are woven in northern Arizona among the Hopi and Navajo people. In the latter country, a loom stands under the shade of some boughs out in the open near almost every Indian hogan, for they like to work in the light, and in this dry country rain comes but seldom. These Indians get the wool for their blankets from their own sheep. Thus, here in the Southwest is a home industry whose products are distributed through traders throughout the country.

THE PACIFIC COAST

Along the Pacific Coast the pattern of the land partakes in a measure of that in the East. The country is broken up topographically into comparatively small units which invite settlement and grouping of people. Temperatures are usually more moderate throughout the year than to the eastward, and rainfall is distributed more evenly from season to season except in the south along the coast and in the Great Valley. Coal and waterpower are available locally or may be brought in for use by industry and for domestic consumption. Although distances are long from north to south, distances from place to place, between localities where people like to live and where they may make a livelihood are not too great. The Pacific Coast area is in physical attribute and atmosphere as distinct from the West of mountain and plain as is the East, and it has certain physical similarities to the East.

The Pacific Northwest manufacturing region has evolved about the two foci of Puget Sound and the Columbia-Willamette-Cowlitz Valleys. Plen-

tiful rainfall well distributed throughout the year and moderate temperatures bring to this region a background prevailing nowhere else in the West. Close to deep-water transportation on the ocean, and accessible from the East and the Inland Empire over the lowland routes provided by the rivers, it can bring in any raw materials or finished products required for industry or domestic consumption. Forests and precipitation on the mountains provide water and waterpower. Lumber and timber products are manufactured in large quantities. Copper from nearby mines is smelted and refined. Fruits and vegetables grown in the fertile valleys are canned and preserved to be shipped east to the more distant areas of dense populations, as also is much of the dairy output. Steel and aluminum are manufactured into products of many different kinds. Here in this area of rather closely spaced population and transportation, service industries to people and transportation have developed—*e.g.*, publishing and printing, coffee and spice grinding, railroad construction and repair shops, automobile and aircraft factories. In short, with the humid climate of moderate temperature, agriculture has been prosperous and diversified, but a large part of its products must be processed before sale, because of the distance of this area from the consuming population in the East, and because the region can grow more than its own population can consume. Canning of fish from its rivers is one of its outstanding industries. The diversity and richness of resources affording comfortable living conditions have resulted in a well-rounded diversity of manufacturing industries, making this region in a sense capable of being nearly self-sufficing.

The confluence of the San Joaquin and Sacramento Rivers in San Francisco Bay with the route out through the Golden Gate to the Pacific Ocean, and the Great Valley of California outline the natural setting of the San Francisco-Great Valley Manufacturing Region. On the flanks of this valley lie deposits of gold and of copper. Gold gave the first impetus which lifted this area out of its tranquil, even, agricultural development, and today the industry of smelting and refining derives from this same metal. Copper continues to be mined and smelted marking the landscape with the searing effect of its fumes along a portion of the western border of the Sacramento Valley. In the southern end of the San Joaquin Valley oil is responsible for the development of petroleum refineries. Rock from the mountains is brought down to cement plants on the rivers, where it is manufactured into cement to be shipped out by river all through the valley for use in highway and other concrete construction.

But it is the agriculture of the Great Valley which dominates industry as a whole. Irrigation waters are obtained from the mountains or from wells, and in the warm climate of the valley citrus fruits and vegetables are

grown and canned to be shipped throughout the country. Wheat is raised and milled into flour. Away from the fogs and mists which flow into the valley through the break in the western mountain rim at the Golden Gate, vineyarding has become an important agricultural, and the drying, canning, and preserving of grapes an important manufacturing industry.

Already the winding channels and sloughs of the delta of the Sacramento and San Joaquin Rivers, east, north, and south of San Francisco Bay have attracted many industries utilizing the agricultural, mineral, and piscatorial wealth of this region, while at the same time industry is more closely concentrated around the Bay itself. The large areas of agricultural land in the Great Valley, its mineral and power resources, the deep waters of the Bay with space for ocean shipping to dock, and for terminals for railroads which run through the valley, all afford the setting for an enlarging industrial development, an increasing population, and a growing commerce.

South of Tehachapi, bordering the coast and extending inland, is an area in southern California that focuses on Los Angeles and San Diego. This patch of Mediterranean climate has invited rich development. Arid lands separate it both physically and industrially from the Southwest, while to the South the international boundary sets its limit. Furthermore, this one area of Mediterranean climate does not foster the same economic, social, and industrial development as does the arid climate of the Southwest and of regions to the north in California. Thus, both physical bounds and physical characteristics delimit the extent and mold the life of the Southern California industrial region.

Within its bounds its physical assets are its Mediterranean climate, the contour of the land which leads it to face toward the long ocean front, its oil, rich soils and waterbearing beds along the Piedmont alluvial fans skirting the mountains, and the larger stores of water for power, irrigation, and domestic use, tapped continually in the snow-fed mountain streams, a great variety of scenery and the contrasting climate of the mountains and lowlands. Farther east in Arizona and New Mexico tributaries of the Rio Grande, the valleys of the Salt and Gila Rivers, and that of the little Colorado River have provided natural highways across the southern mountains and arid lands. These point toward the Pacific Coast in this Southern California region and toward the mountain passes into it through the southern California mountains. It thus is the nearest ocean outlet for the Southwest. To Southern California this means transportation connections with the East.

The combination of physical assets and transportation advantages in Southern California led to the development of some industries. It brought people and the population increased, providing the background for a complex group of industries to serve the region itself, and distribute goods to

adjacent areas and other parts of the United States. Like the other regions of the Pacific Coast, it faces the Orient and foreign trade has become a factor in its industrial life.

This is the background upon which has developed, in this region which must bring in its own power, water, and many of the raw materials that it manufactures, such industries as moving-picture production, the manufacture of organs, motor vehicles, textiles, foundry and machine-shop products, men's and women's clothing, flour milling, rubber tires, canning and preserving of fruits and vegetables, petroleum refining, and a multitude of other goods. The measure and quality of the resources it does possess has enabled it to do this, and to become a distinctive entity in the national life as well as an important industrial region, though in extent it is smaller than some of the other distinctive industrial regions.

AVENUES OF FURTHER STUDY

This, in brief, is a sketch and a characterization of the regions of manufacturing intensity in the United States as revealed by plotting the county data for horsepower of prime movers and electric generators driven by purchased energy used in manufacturing establishments, and by coordinating the facts thus revealed with those gained from maps showing the distribution of people engaged in manufacturing and in agriculture (portrayed in Figs. 2 and 4) and with the impressions and facts gained through personal field and other studies. This map of regions of manufacturing intensity is "final" only insofar as it is the stopping place of the present study. In reality it is presented in the hope that it may be "the beginning of the enterprise."

There seems to have been a tendency on the part of some studying the distribution of manufacturing in the United States to think largely in terms of iron and steel and related industries, while in fact these form only one part of the great fabric of the manufacturing industry. In a most significant sense agriculture and agricultural products have been and are the foundation of many industries here in the United States. Doubtless because these industries in many cases are not so conspicuous on the landscape as those utilizing some of the other raw or semi-finished materials, they have not sufficiently emphasized themselves in the industrial picture. Furthermore, in numerous instances some of the most important of these industries using agricultural raw materials are located in counties for which detailed tabulations have not been published by the Census, or they have been grouped at the end of the Census tables under "All other industries" or "All other counties" because publication would disclose the operations of individual concerns. These and other circumstances have tended to divert attention

from the industries based upon agriculture, when the fact is that the manufacturing industry has a large stake in the agriculture of the country, and in maintaining the productivity of the land. In a very real sense the industrial pattern is formed more or less by the agricultural pattern of the country (*cf.* Figs. 2 and 3). It also is closely related to transportation, to the sources of power and fuel, and to mineral and forest producing regions.

It is earnestly hoped that some of the men and women who now are in the beginning of their productive scholarship may make field and statistical studies, geographical analyses and interpretaitions, which will lead to a better understanding of the regions of manufacturing intensity in the United States, of their close connection with agriculture and other industries, and of the significant contribution being made to the national life by the manufacturing industry.

Washington, D. C.,
February, 1937.

Exhibits at the Syracuse Meeting

The call for papers issued by the Secretary in October 1936 embodied a report of a committee of past presidents of the Association on procedure at the annual meetings. This committee recommended, among other things, that some papers, consisting mainly of maps and charts, might well be presented graphically rather than orally. Pursuant to this proposal, two papers given places on the program were presented as exhibits in rooms adjacent to the meeting place. Preston E. James displayed manuscript maps of South America, and W. O. Blanchard hung photostats of certain maps and graphs illustrative of a forthcoming *Geographical Atlas of Illinois*. Details concerning these graphic papers will be found among the "Abstracts of Papers," published in this issue.

Many papers which were presented orally were supplemented by exhibits of maps, diagrams, and drawings.

A number of these represented recent work in polar exploration, a topic which was given especial prominence at this meeting: the Alexander Forbes expedition to Labrador, the Louise E. Boyd expedition to East Greenland, both in collaboration with the American Geographical Society, work in Alaska by Bradford Washburn of the Harvard Institute of Geographical Exploration, sponsored by the National Geographic Society, and the Byrd Antarctic Expedition, exemplified in drawings by Paul A. Siple.

Exhibits of urban geography were likewise impressive. A comprehensive series covered Syracuse, work of a planning commission in which Eric Faigle of the Department of Geography in the University of Syracuse figured prominently. Malcolm Proudfoot showed what the United States Bureau of the Census is doing in analyzing business areas within large cities, Philadelphia being portrayed as an example. Airplane mosaic photographs of Boston formed part of the display from the Harvard Institute. Robert B. Hall showed rare and beautiful prints of the urban regions bordering the Tokkaido, ancient artery of communication through the most populous section of Japan. Another novelty was a government map of Kano City, British West Africa.

Land utilization was well exemplified. I. G. Davis hung a printed map, *Types of Farming in Connecticut*. C. M. Davis displayed a series of manuscript maps of North Park, Colorado. L. S. Wilson had a series for a Kentucky mining community, similar in kind, but instructively different in character from the North Park display.

C. W. Thornthwaite presented the manuscript maps portraying the life

history of a rainstorm, which have since been published in the *Geographical Review*. Erwin Raisz hung his tabular view of the history of cartography. From the forthcoming *Linguistic Atlas of New England*, charts and maps combined to illustrate this novel aspect of social geography. The U. S. G. S. topographic maps of western New York State were posted for ready reference, mounted on two large canvasses. In another room, equally convenient to the lecture hall, the commercial map publishers exhibited a comprehensive survey of late work, chiefly wall maps.

Note.—The Titles and Abstracts of papers read at Syracuse will be published in the June issue.

Gifts Received by the Association During 1936

Two grants for the promotion of research in geography were announced at the annual banquet of the Association in Syracuse.

A GRANT FOR FIELD STUDY OF PHYSICAL GEOGRAPHY

The first of these was a gift of $2500 from President Wallace W. Atwood, described in the following letter:

Clark University
Worcester, Massachusetts

Office of the President

December 19, 1936

Dr. Preston E. James, Secretary
Association of American Geographers
University of Michigan
Ann Arbor, Michigan

Dear Doctor James:

I have long believed that all those who were interested in the development of geography as a science should be encouraged to carry on field studies. I am particularly anxious to help those engaged in teaching, whose research work is not financed by any state or federal government.

For this purpose I wish to provide at this time a fund of $2,500, which I shall present to the Association through you. Five Hundred dollars of that amount I wish to have awarded as a research grant at the Syracuse meeting of the Association, and the balance I wish to have held as an endowment fund, the income from which to be used by the Council of our Association in making subsequent awards for the promotion of research work. It is my suggestion that the awards be made once in four or five years, when the income may have accumulated to a sufficient amount to assist a research worker to spend a considerable period of time in the field. I want the award to be made each time to one who has demonstrated ability to do original work in the field of geography and who has in hand a problem in physical geography which promises to produce important results.

I think it would be appropriate for the Council to request those who receive these grants from the Association to present the results of their field work, conducted with the support of such a grant, at one of our national meetings and to offer to the Annals of the Association an opportunity to publish those results.

If the Council desires to label or name this foundation I should suggest that you call it "The Wallace W. Atwood Research Fund," and if announcements are made on the programs of the Association the following form might be used:

"Award of Research Grant established by Wallace W. Atwood." Do not understand me as requiring that those announcements be made, but if

any announcement is made of my part in the establishment of this research grant, I have made the above suggestions of the form which I think would be appropriate.

I trust that the example which I have set will be followed by others, and that we may have, as an Association, funds available for the promotion of research work in the various fields of geography.

Respectfully yours,
(Signed) WALLACE W. ATWOOD

This gift was acknowledged by President William Herbert Hobbs as follows:

University of Michigan
Ann Arbor, Michigan
January 6, 1936

Dr. Wallace W. Atwood, President,
Clark University,
Worcester, Massachusetts.

Dear Dr. Atwood:

I am instructed by the Council of the Association of American Geographers assembled at Syracuse on the evening of December 30, 1936, to express to you on their behalf the warm appreciation of your gift to the Association of $2500.00 for the purpose of an award at intervals from four to five years, as may be found practicable for the encouragement and assistance of a worker in the field of physical geography on a problem which promises to yield valuable results. It is the hope of the Council, as it is your own, that this gift in a special field will lead others to provide similar awards within the other fields covered by the activities of the Association. The award which you have provided will be known as the Wallace W. Atwood Award.

To the action of the Council I would add my personal feeling of satisfaction and gratitude for this generous gift to the Association.

I am, as always,
Most sincerely yours,

(Signed) WM. H. HOBBS

When the first part of the Atwood Award was received in the spring of 1936 the secretary sent out an announcement to the membership and asked for nominations. Four candidates were proposed. A committee was appointed by President Hobbs to select the first recipient. The committee was composed of V. C. Finch, chairman, François E. Matthes, and Preston E. James.

Of the four meritorious projects which were submitted the committee was unanimous in its selection of a project by Professor Richard Joel Russell of Louisiana University. Professor Russell proposes to carry on studies of the physical geography of the delta of the Volga River. This work will be

done in connection with an intended scientific mission to the Union of Socialist Soviet Republics during the summers of 1937 and 1938. The investigation of the Volga delta would rest upon a background of and be companion studies with Professor Russell's published and unpublished papers on the delta of the Mississippi River. He proposes to use this award to defray travel expenses in the field, for the hiring of a guide and interpreter, and for the purchase of maps and other materials necessary to the study.

AN UNRESTRICTED GIFT

The second gift received by the Association during 1936 is described in the following letter:

October 10, 1936.

To the Secretaries of the Association of American Geographers and the National Council of Geography Teachers:

The authors listed below have prepared the manuscript for a volume of some 650 pages (printed form) on conservation, entitled *Our Natural Resources and their Conservation,* and have had the same published by John Wiley and Sons of New York who have contracted to pay a 10 and 15 per cent royalty annually on the sale of the book. We, the several authors, separately and jointly, desire to present to the research funds of the Association of American Geographers and the National Council of Geography Teachers this royalty, the associations to have share and share alike so long as the book is on the market. The royalty comes to the associations unincumbered so far as the expenses of the editors are concerned; but there will be charged to the first year's royalty the wholesale cost of fifty copies of the text which are to be distributed among the authors on the basis of the size of each author's contribution.

Authors:
Wallace W. Atwood
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Nels Bengtson
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Ralph Brown
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Helen M. Strong
S. S. Visher
J. R. Whitaker
Frank Williams
Louis Wolfanger

Very sincerely yours,
(Signed) A. E. Parkins,
Russell Whitaker,
Editors

This gift was gratefully acknowledged by the Council.
Preston E. James, *Secretary*